From: Hackett, John [John.Hackett@aptim.com]
Sent: Monday, October 19, 2020 4:45 PM
To: Mccray, Sean-Ryan CTR (USA) [sean-ryan.mccray.ctr@navy.mil]
CC: Stoick, Paul T CIV USN NAVFAC SW SAN CA (USA) [paul.stoick@navy.mil]; Johnson, Nels [Nels.Johnson@aptim.com]; Bercik, Lisa M. [lisa.bercik@aptim.com]
Subject: [Non-DoD Source] HPNS Parcel D-2/UCs RTC and RLSO Files 1 of 2
Attachments: WP Fig6_UC3_Trenches (Rev1).pdf; DF RAWP Oct 2020 RLSO .docx; WP Fig1_Site_Location (Rev1).pdf; WP Fig2_Site_Layout (Rev1).pdf; WP Fig3_D2_Trenches (Rev1).pdf; WP Fig5_UC2_Trenches (Rev1).pdf; Response to Comments - D RAWP 2020_07_13 - PS APTIM.docx

Sean-Ryan,

Attached please find the RTCs and revised Word files in RLSO. This first email has the updated Work Plan text and figures, and a second email will have the updated appendix files including the SAP. Please let us know if you have any questions or we should discuss any of the responses further.

Thanks,
John

JOHN R HACKETT, PE, CHP, PMP
Project Manager

APTIM | Government Strategic Business Unit

O 303 486 2552
(b) (6) [redacted]
E john.hackett@aptim.com

APTIM

5690 DTC Boulevard, Suite 600
Greenwood Village, CO 80111

aptim.com

Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

DRAFT FINAL
REMOVAL SITE EVALUATION WORK PLAN

Radiological Confirmation Sampling and Survey
Parcels D-2, UC-1, UC-2, and UC-3

FORMER HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

October 2020

DCN: APTM-0006-5345-0012

Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

DRAFT FINAL
REMOVAL SITE EVALUATION WORK PLAN

Radiological Confirmation Sampling and Survey
Parcels D-2, UC-1, UC-2, and UC-3

FORMER HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

October 2020

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
BRAC PMO West
33000 Nixie Way, Bldg. 50
San Diego, CA 92147

Prepared by:

Aptim Federal Services, LLC
4005 Port Chicago Highway, Suite 200
Concord, CA 94520

Contract Number: N62473-17-D-0006; Task Order: N6247318F5345
DCN: APTM-0006-5345-0012

Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

DRAFT FINAL
REMOVAL SITE EVALUATION WORK PLAN

Radiological Confirmation Sampling and Survey
Parcels D-2, UC-1, UC-2, and UC-3

FORMER HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

October 2020

Raymond Schul Technical Lead	Date
Nels Johnson, PE PMP Project Manager	Date

Contract Number: N62473-17-D-0006; Task Order: N6247318F5345
DCN: APTM-0006-5345-0012

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

List of Figures

List of Tables

List of Appendices

Acronyms and Abbreviations

μR/hr	microroentgen per hour
^{90}Sr	strontium-90
^{137}Cs	cesium-137
^{226}Ra	radium-226
^{230}Th	thorium-230
^{234}U	uranium-234
^{238}U	uranium-238
AHA	activity hazard analysis
ALARA	as low as reasonably achievable
APP/SSHP	*Final Accident Prevention Plan, Parcels D-2, UC-1, UC-2, and UC-3, Radiological Confirmation Sampling and Survey, Former Hunters Point Naval Shipyard, San Francisco, California*
APTIM	Aptim Federal Services, LLC
BMP	best management practice
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
cm	centimeter
cm/s	centimeter per second
cm^2	square centimeter
cpm	count per minute
DOT	U.S. Department of Transportation
dpm	disintegration per minute
DQA	data quality assessment
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
ESU	excavation soil unit
g/cm^3	gram per cubic centimeter
GPS	global positioning system
HPNS	former Hunters Point Naval Shipyard
HRA	*Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939–2003, Hunters Point Shipyard, San Francisco, California*
IL	investigation level
keV	kiloelectron volt
LBGR	lower boundary of the gray region
LLRW	low-level radioactive waste
m/s	meter per second
m^2	square meter
m^3	cubic meter
MARSSIM	*Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*
MDC	minimum detectable concentration
MDCR	minimum detectable count rates
MOU	Memorandum of Understanding

Acronyms and Abbreviations (continued)

NaI	sodium iodide
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea Systems Command
Navy	U.S. Department of the Navy
NORM	naturally-occurring radioactive material
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocurie per gram
Pr	probability
PRSO	Project Radiation Safety Officer
QA	quality assurance
QC	quality control
RACR	remedial action completion report
RAO	remedial action objective
RASO	Radiological Affairs Support Office
RBA	reference background area
RCA	radiologically controlled area
RCRA	Resource Conservation and Recovery Act
RG	remediation goal
ROC	radionuclide of concern
ROD	Record of Decision
ROI	region of interest
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RPP	*Final Radiation Protection Plan, Parcels D-2, UC-1, UC-2, and UC-3, Radiological Confirmation Sampling and Survey, Former Hunters Point Naval Shipyard, San Francisco, California*
RSY	radiological screening yard
RWP	radiological work permit
S3	soil sorting system
SAP	sampling and analysis plan
SD	storm drain
SFU	sidewall floor unit
SS	sanitary sewer
SSHO	Site Safety and Health Officer
SU	survey unit
TtEC	Tetra Tech EC, Inc.
TU	trench unit
UBGR	upper boundary of the gray region
VD	virtual detector
VOC	volatile organic compound
VSP	*Visual Sample Plan: A Tool for Design and Analysis of Environmental Sampling*
WP	work plan

1.0 INTRODUCTION

This removal site evaluation work plan (WP) presents the specific tasks and procedures Aptim Federal Services, LLC (APTIM) will implement, to investigate and evaluate the former sanitary sewer (SS) and storm drain (SD) trenches previously excavated and two impacted, previously surveyed buildings within Parcels D-2, UC-1, UC-2, and UC-3, former Hunters Point Naval Shipyard (HPNS), San Francisco, California. Radiological surveys and remediation were previously conducted at Parcels D-2, UC-1, UC-2, and UC-3 by Tetra Tech EC, Inc. (TtEC), under contracts with the U.S. Department of the Navy (Navy). Radiological surveys and remediation were previously conducted at HPNS as part of a basewide time-critical removal action. TtEC, under contracts with the Navy, conducted a large portion of the basewide time-critical removal action, including Parcels D-2, UC-1, UC-2, and UC-3. Data manipulation and falsification were committed by TtEC employees during the time-critical removal action. An independent third-party evaluation of the data identified evidence of manipulation, falsification, and data quality issues with data collected at Parcels D-2, UC-1, UC-2, and UC-3. As a result, the Navy will conduct investigations at radiologically impacted soil and building sites in Parcels D-2, UC-1, UC-2, and UC-3 that were surveyed by TtEC.

The purpose of the investigation presented in this WP is to determine whether site conditions are compliant with the remedial action objectives (RAOs) in the records of decision (RODs) (Navy, 2009a, 2009b, 2010, 2014) for Parcels D-2, UC-1, UC-2, and UC-3. The RAO for radiologically impacted soil and structures is to prevent receptor exposure to radionuclides of concern (ROCs) in concentrations that exceed remediation goals (RGs) for potentially complete exposure pathways. Additional reference background areas (RBAs) may be identified to confirm, or update as necessary, estimates of naturally-occurring and man-made background levels for ROCs not attributed to Navy operations at HPNS. A statistical comparison of site data to applicable reference area data will be conducted. The goal of this work is to demonstrate that the unrestricted radiological free release letters for the former SS/SD lines in Parcels D-2, UC-1, UC-2, and UC-3 may be reinstated based on the evaluation of the new data to be collected. As described herein, the term “former SS/SD trench locations” will be used to describe the footprint (boundary and depth) of the previously removed soil, pipes, and manholes excavated as part of a time-critical removal action by TtEC.

The lead agency at HPNS is the Navy, and the lead federal regulatory agency is the U.S. Environmental Protection Agency (EPA). The Navy will continue to work with EPA and the State of California throughout the planning and site investigation process. The performance work statement for Parcels D-2, UC-1, UC-2, and UC-3 describes the methods and procedures required for performing an investigation that will provide data to allow property transfer and support a radiological unrestricted release recommendation for former SS/SD lines, impacted buildings and impacted former building sites in Parcels D-2, UC-1, UC-2, and UC-3. Parcels UC-1, UC-2, and D-2 have been transferred to the City of San Francisco.

The approach for the collection and evaluation of data is based on the *Final Parcel G Removal Site Evaluation Work Plan, Former Hunters Point Naval Shipyard, San Francisco, California* (Navy, 2019a) and the *Final Revision 1 Parcel G Removal Site Evaluation Work Plan Addendum, Radiological Investigation, Survey, and Reporting, Parcel G, Former Hunters Point Naval Shipyard, San Francisco, California* (APTIM, 2020a). For soil, a phased approach was designed based on a proposal by the regulatory agencies to achieve a high level of confidence that ROD RGs (Navy, 2009a, 2009b, 2010, 2014) have been met for soil. For Phase 1, 100 percent of soil will be re-excavated and characterized at 17 former trench locations associated with former SS/SD lines. Soil sampling and surface scanning at the remaining 30 trench locations will be performed as part of Phase 2 to increase confidence that the current site conditions comply with the ROD RAO (Navy, 2009a, 2009b, 2010, 2014). The Navy will excavate 100 percent of Phase 2 trench locations if contamination is identified in the Phase 1 trench locations.

The activities presented in this WP will be conducted in accordance with this WP and its appendices. Section 6.0 presents project requirements, including personnel roles and responsibilities, required training, and health and safety protocols are.

1.1 Scope of Work

The scope of the planned activities consists of the following elements:

- Preparing required WP documents to guide the work
- Re-excavate a portion of the former SS/SD line excavations
- Collect characterization and confirmation soil samples
- Conduct radiological scanning and/or sampling of excavated soil to determine appropriate reuse (backfill or disposal)
- Conduct a radiological investigation of soil near the corner of Fischer and Spear Avenues
- Conduct radiological surveys of impacted portion of Buildings 813 and 819
- Perform remediation if RGs are exceeded and activity cannot be attributed to naturally-occurring radioactive material or anthropogenic background
- Prepare a remedial action completion report (RACR)
- Coordinate fieldwork with the City of San Francisco and their developer (FivePoint)
- Perform additional tasks as directed by the Navy

1.2 Project Schedule

Table 1 provides the project schedule for the Parcels D-2, UC-1, UC-2, and UC-3 soil investigation and removal activities.

1.3 Project Organization

Table 2 provides key personnel.

1.4 Site Safety

APTIM will follow Occupational Safety and Health Administration excavation regulations and notification requirements. Excavations will be conducted in accordance with the following:

- California Health and Safety Code
- California Code of Regulations Title 8, Sections 1539 through 1541
- Title 29 Code of Federal Regulations (CFR), Parts 1910 and 1926, requirements
- *Safety and Health Requirements Manual*, EM 385-1-1 (U.S. Army Corps of Engineers, 2014)
- *Unified Facilities Guide Specifications,* Section 01 35 26 (Naval Facilities Engineering Command [NAVFAC], 2012)

Field activities will be conducted in accordance with the *Final Accident Prevention Plan, Parcels D-2, UC-1, UC-2, and UC-3, Radiological Confirmation Sampling and Survey, Former Hunters Point Naval Shipyard, San Francisco, California* (APP/SSHP; APTIM, 2019a) and the *Final Radiation Protection Plan, Parcels D-2, UC-1, UC-2, and UC-3, Radiological Confirmation Sampling and Survey, Former Hunters Point Naval Shipyard, San Francisco, California* (RPP; APTIM, 2019b).

1.5 Project Requirements

This section discusses required project plans.

1.5.1 Accident Prevention Plan/Site Safety and Health Plan

APTIM will submit the APP/SSHP (2019a) for this work to the Navy under separate cover. The APP/SSHP will be prepared to support fieldwork in accordance with the *Safety and Health Requirements Manual,* EM 385-1-1 (U.S. Army Corps of Engineers, 2014) and the *Unified Facilities Guide Specifications,* Section 01 35 26 (NAVFAC, 2012).

1.5.2 Sampling and Analysis Plan

The sampling and analysis plan (SAP) (Appendix B) was developed to provide guidance on soil sampling, chain-of-custody, laboratory analysis, and quality assurance (QA)/quality control (QC) requirements. The SAP was also written in accordance with the *Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs* (EPA, 2005) and the *Quality Systems Manual for Environmental Laboratories*, Version 5.1 (U.S. Department of Defense, 2017).

1.5.3 Contractor Quality Control Plan

The contractor QC plan (Appendix C) was prepared in accordance with the *Unified Facilities Guide Specifications,* Section 01 35 26 (NAVFAC, 2012).

1.5.4 Traffic Control Plan

The traffic control plan (Appendix D) was prepared to address potential traffic impacts during the course of work.

1.5.5 Dust Management and Air Monitoring Plan

The Dust Management and Air Monitoring Plan (Appendix E) identifies procedures to reduce fugitive dust emissions and for the air quality monitoring of fugitive dust emissions that may be generated during radiological removal activities at Parcels D-2, UC-1, UC-2, and UC-3.

1.5.6 Stormwater Management Plan

The Stormwater Management Plan (Appendix F) presents the substantive measures that APTIM will implement to minimize sediment and other pollutants in stormwater discharges during the radiological removal activities at Parcels D-2, UC-1, UC-2, and UC-3.

1.5.7 Radiological Protection Plan

The RPP (APTIM, 2019b) outlines day-to-day management of radioactive materials during this project. The RPP will support fieldwork and will be submitted to the Navy under separate cover. APTIM will implement radiological control measures under its U.S. Nuclear Regulatory Commission (NRC) Materials License and California State Radiological License, which Section 6.0 and the RPP (APTIM, 2019b) further describe.

1.6 Removal Site Evaluation Work Plan Organization

This WP consists of nine sections. The WP is organized as follows:

- Section 1.0, “Introduction”—Section 1.0 provides the introduction, project organization, site safety, scope of work, project requirements, and the WP organization.
- Section 2.0, “Conceptual Site Model”—Section 2.0 describes the site location, site history, and the nature and extent of contamination.
- Section 3.0, “Soil Investigation Design and Implementation”—Section 3.0 describes the data quality objectives (DQOs), ROCs, RGs, instrumentation, and radiological investigation design and implementation for soil at Parcels D-2, UC-1, UC-2, and UC-3.
- Section 4.0, “Building Investigation Design and Implementation”—Section 4.0 describes the DQOs, ROCs, RGs, instrumentation, and radiological investigation design and implementation for Buildings 813 and 819.

- Section 5.0, "Data Evaluation and Reporting"—Section 5.0 describes the data quality validation, data quality assessment (DQA), investigation of potential areas of elevated activity, comparison of data to RG values and background, determining equilibrium status, and reporting.
- Section 6.0, "Radioactive Materials Management and Control"—Section 6.0 describes the project roles and responsibilities, licensing and jurisdiction, radiological protection plan, radiological work permits (RWPs), radiological control area establishment and control, and documentation and records management.
- Section 7.0, "Waste Management Plan"—Section 7.0 presents the project waste descriptions, radiological waste management, nonradiological waste management, waste minimization, compliance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, documentation, and updates to the waste management plan.
- Section 8.0, "Environmental Protection Plan"—Section 8.0 describes the land resources and vegetation, fish and wildlife, threatened, endangered, and sensitive species, wetlands and streams, stormwater, sediment, and erosion control, air quality and dust control, noise prevention, construction area delineation, and general operations.
- Section 9.0, "References"—Section 9.0 includes a list of documents used to compile this WP.
- Appendices A through H—Responses to Comments, SAP, contractor QC plan, traffic control plan, dust management and air monitoring plan, the stormwater management plan, gamma scan minimum detectable concentrations (MDCs), and the soil sorting operation plan are included as Appendices A, B, C, D, E, F, G, and H respectively.

2.0 CONCEPTUAL SITE MODEL

This section presents an updated conceptual site model. The conceptual site model summarizes the site description, history, and current status related to radiologically impacted buildings, and former SS/SD lines identified in the *Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939–2003, Hunters Point Shipyard, San Francisco, California* (HRA; Naval Sea Systems Command [NAVSEA], 2004).

2.1 Site Location and Description

HPNS is located in southeastern San Francisco on a peninsula that extends east into the San Francisco Bay (Figure 1). HPNS consists of 853 acres: 407 acres on land and 446 acres underwater. Parcel D-2 consists of approximately 5.32 acres located north of Parcel G in HPNS. Building 813, within Parcel D-2, a 68,644-square-foot, four-story warehouse, with two open-front sheds on the west side of the building. Parcel UC-1 is approximately 3.9 acres in area and extends the length of Spear Avenue. Building 819 is located on the western end of Parcel UC-1 and is approximately 1,315.1 square feet, with two rooms (“Dry Well” and “Wet Well”), which are each approximately 20 feet in depth. Parcel UC-2 is approximately 3.9 acres in area and encompasses a section of Robinson Street and the length of Fischer Avenue. Parcel UC-3 is approximately 11.2 acres and extends the length of Crisp Road at HPNS. Parcels UC-2 and UC-3 do not contain buildings nor structures that will be investigated. Figure 2 shows Parcels D-2, UC-1, UC-2, and UC-3.

2.2 Site History

In 1939, the Navy purchased the land portion of HPNS and leased it to Bethlehem Steel Corporation. At the start of World War II in 1941, the Navy took possession of the property and operated it as a shipbuilding, repair, and maintenance facility until 1974 when the Navy deactivated HPNS. HPNS was also the site of the Naval Radiological Defense Laboratory from the late-1940s until 1969. From 1976 to 1986, the Navy leased HPNS to Triple A Machine Shop, Inc., a private ship repair company. In 1986, Triple A Machine Shop, Inc. ceased operations and the Navy resumed occupancy through 1989. In 1991, HPNS was placed on the Navy Base Realignment and Closure (BRAC) list, and its mission as a shipyard ended in April 1994. A history of Navy radiological operations at HPNS is provided in the HRA (NAVSEA, 2004). The HRA concluded that low levels of radiological contamination exist within the confines of HPNS. The review of previous radiological activities, cleanup actions, and release surveys identified no imminent threat or substantial risk to tenants or the environment of HPNS or the local community.

The former SS/SD line system was originally designed and built in the 1940s as a combined system to discharge into the San Francisco Bay. The combined systems grew in sections and then underwent a series of separations to allow for the installation of dedicated sanitary sewer piping and pump stations that would discharge off site. Complete separation of the combined systems was never achieved and past inspections indicate that cross-connections may still exist.

2.3 Nature and Extent of Potential Contamination

Past site activities associated with known or potential contaminant releases at Parcels D-2, UC-1, UC-2, and UC-3 were identified.

2.3.1 Radionuclides of Concern

According to the HRA (NAVSEA, 2004) Building 813 was previously used as a general warehouse and offices, a supply storehouse, and the Disaster Control Center. A leaking 300 microcurie strontium-90 (^{90}Sr) source was found in the disaster control inventory. Because a cabinet containing unspecified radioactive materials was found in the building, radium-226 (^{226}Ra) and cesium-137 (^{137}Cs) were included as ROCs for the scoping survey performed in 2006.

Building 819 is the sanitary sewer pump station. The HRA (NAVSEA, 2004) listed the contamination potential of the building as likely, because there was a high potential for release of radioactive material to the sanitary sewer system from HPNS. The ROCs listed in the HRA were ^{137}Cs and ^{226}Ra.

As a result of historical radiological operations at HPNS, small amounts of low-level radioactive liquid wastes were released with dilution to the sanitary sewers. The ROCs listed in the HRA (NAVSEA, 2004) were ^{137}Cs, ^{226}Ra, and ^{90}Sr.

2.3.2 Potential Migration and Exposure Pathways

Potential migration pathways include the following:

- Releases to soil and air
- Releases to SS lines
- Releases to SDs
- Runoff from surface spills
- Releases from potentially leaking former SS/SD lines to surrounding soil
- Release of sediments from breaks or seams during power washing of drain lines

Potential exposure pathways include the following:

- Soil
  - — External radiation from ROCs
  - — Incidental ingestion and inhalation of soil and dust with ROCs for intrusive activities disturbing soil beneath the durable cover (only construction worker receptor)

- Building surfaces
  - External radiation from ROCs
  - Inhalation and incidental ingestion of resuspended radionuclides

2.3.3 Current Status

HPNS is currently not an active military installation. HPNS was selected for closure in 1991 pursuant to the terms of the Defense BRAC Act of 1990. The Navy leased many HPNS buildings to private tenants for more than 20 years. Parcels A, D-2, UC-1, and UC-2 have been transferred to the City and County of San Francisco for nondefense use and the remaining areas of HPNS are planned to also be transferred. Known sources were removed by the Navy using the applicable standards at the time. Former SS/SD line removal investigation was conducted between 2009 and 2010, and investigations in Building 813 were conducted between 2006 and 2008. Buildings 813 and 819 are currently vacant.

As previously discussed, following investigation and removal actions, there were allegations that TtEC potentially manipulated and falsely represented data, and some allegations have been confirmed. In addition, the on-site laboratory used a screening method to analyze ^{226}Ra that may have reported at levels higher than actual radioactivity. TtEC presented conceptual site models in RACRs that were based on potentially falsified data and screening results for ^{226}Ra reported by the on-site laboratory that may have been biased high. The results of additional investigation activities presented in this WP will be used to update the conceptual site model as needed.

3.0 SOIL INVESTIGATION DESIGN AND IMPLEMENTATION

This section describes the DQOs, ROCs, RGs, investigation levels (ILs) and implementation for soil at Parcels D-2, UC-1, UC-2, and UC-3.

3.1.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed to define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data. These outputs are used to develop a data collection design that meet performance criteria and other design requirements and constraints. EPA specified a seven-step process to develop DQOs (EPA, 2006), which was adapted for use in the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (MARSSIM; EPA et al., 2000). The following subsections summarize the DQOs for the soil investigations.

3.1.1.1 Step One—State the Problem

Recent evidence was discovered to suggest that data manipulation and falsification were committed by a contractor during past former SS/SD line removal actions. The findings call into question the reliability of soil data previously collected and there is uncertainty whether radiological contamination was present or remains in place. Therefore, the property is unable to be transferred as planned. Based on the uncertainty and the description of radiological activities in the HRA (NAVSEA, 2004), there is a potential for residual radioactivity to be present in soil.

3.1.1.2 Step Two—Identify the Objective

The primary objective is to determine whether site conditions are compliant with their respective RAOs (Navy, 2009a, 2009b, 2014).

3.1.1.3 Step Three—Identify Inputs to the Objective

The inputs include surface soil and subsurface soil analytical data for the applicable ROCs and gamma scan survey measurements to identify biased soil sample locations. RBA surface and subsurface soil analytical data for ROCs will also be used to confirm, or update as necessary, estimates of naturally-occurring and man-made background levels for ROCs not attributed to Navy operations at HPNS. The *Final Background Soil Study Report, Base Realignment and Closure, Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California* (CH2M Hill, Inc., 2020) will be used to determine the appropriate RBA.

3.1.1.4 Step Four—Define the Study Boundaries

Tables 3 and 4 present Phase 1 and Phase 2 trench locations (Figures 3 through 6). For Phase 1, 100 percent of soil will be re-excavated and characterized at 17 former trench locations associated with former SS/SD lines. Soil sampling and surface scanning at the remaining 30 trench locations will be performed as part of Phase 2.

3.1.1.5 Step Five—Develop a Decision Rule

If the investigation results demonstrate that there are no exceedances determined from a point-by-point comparison with the statistically-based RGs at agreed upon statistical confidence levels, or that residual ROC concentrations are naturally-occurring radioactive material (NORM) or anthropogenic background, then a RACR will be developed to present the final site conditions.

If the investigation results demonstrate exceedances of the RGs determined from a point-by-point comparison with the statistically-based RGs at agreed upon statistical confidence levels and are not shown to be NORM or anthropogenic background, remediation will be conducted, followed by a RACR. Remediation will be based on the following:

- If one Phase 1 trench does not meet the RAOs, all Phase 2 trenches will be excavated.
- If Phase 1 trenches meet the RAOs, Phase 2 will be initiated for remaining trenches.

  If any Phase 2 TU does not meet the Parcel D-2, UC-1, UC-2, or UC-3 ROD RAO, the TU will be fully excavated in the exact manner as Phase 1.

The RACR will describe the results of the investigation, explain remediation performed, compare the distribution of data from the sites with applicable reference area data, and provide a demonstration that site conditions are compliant with the respective RAOs through the use of multiple lines of evidence including application of statistical testing with agreed upon statistical confidence levels on the background data.

3.1.1.6 Step Six—Specify the Performance Criteria

Section 5.0 presents the data evaluation process for demonstrating compliance with the respective RAOs.

Compare each ROC sample concentration to the corresponding RG (Section 3.3):

- If ROC concentrations for samples are less than or equal to the RG plus background for ^{226}Ra, and are less than or equal to the RG or background, whichever is higher, for ^{90}Sr and ^{137}Cs, then compliance with the respective RAO is achieved.

Compare sample data to appropriate RBA data from HPNS (Section 5.0). Multiple lines of evidence will be evaluated to determine whether site conditions are consistent with NORM or anthropogenic background. The data evaluation may include, but is not limited to, population-to-population comparisons, use of a maximum likelihood estimate or background threshold value, graphical comparisons, and comparison with regional background levels:

- If residual ROC concentrations are consistent with NORM or anthropogenic background, then site conditions comply with the respective RAOs.
- If ^{226}Ra gamma spectroscopy concentration exceeds the ^{226}Ra RG and the range of expected NORM concentrations, then the soil sample will be analyzed for uranium-238 (^{238}U), uranium-234 (^{234}U), thorium-230 (^{230}Th) and ^{226}Ra using comparable analytical methods (e.g., alpha spectroscopy). If the concentrations of radionuclides in the uranium natural decay series are consistent with the assumption of secular equilibrium, then the ^{226}Ra concentration is NORM, and site conditions comply with the respective RAOs.
- If a result is greater than the RG and cannot be attributed to NORM or anthropogenic background, then remediation will be performed prior to backfill.

3.1.1.7 Step Seven—Develop the Plan for Obtaining Data

Phase 1 trenches—The radiological investigation will be conducted on a targeted group of 17 former trench locations associated with former SS/SD lines in Parcels D-2, UC-1, UC-2, and UC-3. For Phase 1 trenches, the durable cover (including asphalt, asphalt base course, concrete, gravel, debris, or obstacles) will be removed to expose the target soil. Soil will be excavated to the original trench boundaries, as practicable. Following excavation to the original trench boundaries, an additional excavation of approximately 6 inches of the trench sidewalls and floors will be performed to provide ex situ scanning and sampling of the trench sidewalls and floors. Excavated soil will be 100 percent gamma scanned by one of two methods: soil may be laid out on radiological screening yard (RSY) pads for a surface scan, or soil may be processed and scanned using automated soil segregation technology. Systematic and biased samples will be collected from the excavated soil for off-site analysis.

Phase 2 trenches—Additional gamma scan surveys and soil sampling will be conducted on the remaining 30 former trench locations associated with former SS/SD lines in Parcels D-2, UC-1, UC-2, and UC-3. Each Phase 2 trench will undergo a 100 percent radiological surface gamma scan of accessible areas, along with soil sample collection via borings from soil within the former trench boundaries and from soil representing the former trench walls and floors, as practicable. The borings will be advanced approximately 6 inches below the depth of previous excavation and will be gamma scanned upon retrieval. Phase 2 will only be performed if no contamination is found during Phase 1. If contamination is found during Phase 1, then Phase 2 trenches will be excavated and investigated in the exact manner used for the Phase 1 trenches.

3.2 Radionuclides of Concern

The ROCs for Parcels D-2, UC-1, UC-2, and UC-3 are based on the HRA (NAVSEA, 2004) and RODs (Navy, 2009a, 2009b, 2010, 2014). The ROCs for the former SS/SD lines are ^{226}Ra, ^{137}Cs, and ^{90}Sr.

3.3 Remediation Goals

The soil data from the radiological investigation will be evaluated to determine whether site conditions are compliant with the respective RAOs in the RODs (Navy, 2009a, 2009b, 2010, 2014). The RAOs are to prevent exposure to ROCs in concentrations that exceed RGs for potentially complete exposure pathways. Table 5 presents the RG for each ROC. The soil data will be compared to the values in Table 5 using a single sample comparison and evaluated, as described in Section 5.0.

3.3.1 Investigation Levels

The same survey methods and equipment that will be used for conducting a survey in an impacted area will be used for the background area data collection. Reference background data and ILs will be provided to the radiological control technicians prior to the start of a survey for their use during data collection. Gamma scanning and static measurements collected from the reference area will be used to develop instrument-specific ILs for gamma walkover survey and gamma static measurements. Each scan IL is based on the instrument-specific mean and standard deviation as determined by the scan of the reference area. Each static IL is based on the instrument-specific mean and standard deviation as determined by a set of 20 systematic static measurements collected from the reference area. Scan and static data will also be collected with the RS-700 system to establish background data for the spectral analysis process. The RS-700 gamma scan data analysis process is conducted, as described in Section 3.5.1.1. The spectral analysis process includes the use of critical levels. Critical levels, as defined in MARSSIM Section 6.7.1 (EPA et al., 2000), are calculated based on background levels. The critical level is the level, in counts, at which there is a statistical probability (with a predetermined confidence) of incorrectly identifying a measurement system background value as greater than background.

For gamma scan survey measurements collected on trench surfaces or RSY pads, individual measurement results above the IL will prompt investigations that may result in the collection of biased samples or additional field measurements to determine the areal extent of the elevated activity. Potential causes of elevated gamma scanning measurements may include discrete radioactive objects (e.g., deck markers), localized soil contamination, measurement geometry effects, and NORM.

The RS-700 also may be used to assess gamma scan investigation locations using a one-minute or greater static count and spectral analysis to compare the activity at a specific point to background. For gamma scan investigations, the net spectrum will be plotted and the critical levels assessed for ROC-specific energy ranges to find out if there is activity present above background. Critical levels, as defined in the MARSSIM Section 6.7.1 (EPA et al., 2000), represent thresholds above which net counts are statistically greater than background. If the gamma spectroscopy detector system static measurements identify elevated locations, biased samples will be collected; otherwise, the static count spectra will be provided in the data reports. Section 3.5.1.1 describes the analysis of scanning data collected by the RS-700 system and triggers for further investigation. ILs for other field instrumentation are typically equal to an upper estimate of the instrument- and material-specific background (such as the mean plus three standard deviations). Appropriate instrument and site-specific gamma scan ILs for gross gamma (i.e., full-energy spectrum) measurements will be determined following mobilization.

Section 3.5 describes the minimum gamma scan survey instrument requirements and the methodology to determine instrument soil scan MDCs in soil.

3.3.2 Reference Background Areas

The background reference area is a geographical area from which representative radioactivity measurements are performed for comparison with measurements performed in an impacted area. The reference area is an area that should have similar physical, chemical, radiological, and biological characteristics as the impacted area(s) being investigated, but that has not been identified as impacted.

The reference area behind Building 810 (Figure 1) will be used to collect soil instrument-specific background levels. The non-radiologically impacted soil area is approximately 5,625 square feet (523 square meters). Gamma scanning and static measurements collected from the reference area will be used to develop instrument-specific critical levels (Lcs) and investigation levels (ILs) for GWS and gamma static measurements. The same survey methods and equipment that will be used for conducting the surveys will be used for the background area data.

For asphalt, onsite RBAs 1, 2 and/or 4, established in the *Final Background Soil Study Report, Base Realignment and Closure, Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California* (CH2M Hill, Inc., 2020) will be used (Figure 1). These paved RBAs have already been determined to be non-radiologically impacted. The asphalt RBA used will depend on actual site conditions and which RBA is most similar to the parcel asphalt.

If needed, additional reference areas may be established with the approval of the Navy. The same survey methods and equipment that will be used for conducting a survey area will be used for the background area data collection.

3.4 Radiological Investigation Design

This subsection describes the design of the radiological investigation, including gamma scan surveys and soil sampling. The radiological investigation design has the ultimate requirement to demonstrate compliance with the respective RAOs (Navy, 2009a, Navy, 2009b, Navy, 2014). The SAP (Appendix B) provides additional guidance on soil sampling, chain-of-custody, laboratory analysis, and QC/QC requirements.

A phased investigation approach is planned for surface and subsurface trench soil associated with former SS/SD lines. Phase 1 includes the radiological investigation of 17 former trenches and Phase 2 includes the remaining 30 trenches in Parcels D-2, UC-1, UC-2, and UC-3. The approach is based on a proposal by the regulatory agencies to achieve a high level of confidence that the respective RAOs have been met for soil. For Phase 1, 100 percent of soil will be re-excavated and characterized at 17 former trench locations associated with former SS/SD lines. Soil sampling and surface scanning at the remaining 30 trenches will be performed as part of Phase 2 to increase confidence that current site conditions comply with the respective RAOs. The Navy will re-excavate 100 percent of the Phase 2 trenches if contamination is identified in Phase 1 trenches.

The principal features of the investigation protocol to be applied to the trenches are discussed herein and include the following:

- Number of samples
- Locating samples
- Establishing radiological background
- Trench unit (TU) design

To the extent possible, manual data entries will be reduced or eliminated through use of electronic data collection and transfer processes. A TU refers to the former trench units designated by TtEC. An excavation soil unit (ESU) refers to a 152 cubic meters (m^3) (maximum size) batch of soil that will be excavated from a given TU. A sidewall floor unit (SFU) refers to a 152 m^3 (maximum size) batch of soil that will be comprised of the over-excavation of 6 inches from the sidewalls and bottom of a TU when excavation to the original depth is reached.

3.4.1 Number of Samples

Soil samples will be collected on a systematic sampling grid and/or from biased locations identified by the gamma scanning surveys. The number of systematic soil samples collected will be based on MARSSIM Sections 5.5.2.2 and 5.5.2.5 (EPA et al., 2000) using ^{226}Ra as the example basis for calculating the minimum sample frequency. Even if the MARSSIM-recommended or other statistical tests are not used to evaluate site data, these calculations serve as a basis for determining the number of samples per survey unit (SU) to be collected. The number of biased samples will be determined based on the results of scan and/or static surveys, and a minimum of one biased sample will be collected in every ESU or SFU.

MARSSIM Section 5.5.2.2 (EPA et al., 2000) defines the method for calculating the number of soil samples when residual radioactivity is uniformly present throughout a SU. Therefore, determining the number of samples will be based on the following factors:

- RG for radioactivity in soil (upper boundary of the gray region [UBGR])
- Lower boundary of the gray region (LBGR)
- Estimate of variability (standard deviation [σ]) in the reference area and the SUs

- Shift (Δ = UBGR-LBGR)
- Relative shift ([UBGR-LBGR]/ σ) (Equation 3-1)
- Decision error rates for making a Type I or Type II decision error that the mean or median concentration exceeds the RG (MARSSIM Table 5.2)

Each of the preceding factors is addressed in the following paragraphs. Example data are provided to assist in explaining the process for calculating the minimum sample frequency. The DQA of SU data will include a retrospective power curve (MARSSIM Appendix I [EPA et al., 2000]) to demonstrate that a sufficient number of samples was collected to meet the project objectives.

As stated in *Final Background Soil Study Report, Base Realignment and Closure Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California* (CH2M Hill, Inc., 2020), the initial background threshold value (BTV) to be used for site-specific data comparisons is the offsite value of 0.861 pCi/g. The ^{226}Ra RG is defined as 1 picocurie per gram (pCi/g) plus background. .

MARSSIM (EPA et al., 2000) defines a gray region as the range of values in which the consequences of decision error on whether the ^{226}Ra concentration is less than or exceeds the RG are relatively minor. The RG of 1 pCi/g of ^{226}Ra above background (0.861 pCi/g) was selected to represent the UBGR (1.861 pCi/g). the LBGR is the median concentration in the SU, and the retrospective power will be determined after the survey is completed. Given the absence of data prior to performing the investigation activities, MARSSIM Section 2.5.4 suggests arbitrarily selecting the LBGR as half the RG. Therefore, for this example, the LBGR = 0.5 pCi/g + 0.861 pCi/g = 1.361 pCi/g. Assuming the UBGR equals the RG, then Δ = 0.5 pCi/g for this example.

MARSSIM (EPA et al., 2000) defines σ as an estimate of the standard deviation of the measured values in the SU. Because data will not be available until the investigation activities are completed, MARSSIM recommends using the standard deviation of the RBA as an estimate of σ. Of the four possible reference background areas presented in *Final Background Soil Study Report, Base Realignment and Closure Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California* (CH2M Hill, Inc., 2020), the largest σ of 0.268 is conservatively used for this example.

The relative shift is calculated based on MARSSIM Section 5.5.2.2 (EPA et al., 2000), as shown in Equation 3-1:

Equation 3-1

$$\frac{\Delta}{\sigma} = \frac{(UBGR-LBGR)}{\sigma} = \frac{(RG-LBGR)}{\sigma} = \frac{(1.861-1.361)}{0.268} = 1.9$$

The minimum number of samples assumes the ^{226}Ra concentration in the SU exceeds the RG. Type I decision error is deciding that the ^{226}Ra concentration in the SU is less than the RG when it actually exceeds the RG. To minimize the potential for releasing soil with concentrations above the RG, the Type

I decision error rate is set at 0.01. Type II decision error is deciding that the ^{226}Ra concentration exceeds the RG when it is actually less than the RG. To protect against remediating soil with concentrations below the RG, the Type II decision error rate is set at 0.05.

MARSSIM Table 5.3 (EPA et al., 2000) lists the minimum number of samples to be collected in each SU and RBA based on the relative shift and decision error rates. For a relative shift of 1.9, with a Type I decision error rate of 0.01 and a Type II decision error rate of 0.05, MARSSIM Table 5.3 recommends a minimum of 19 samples in each SU and RBA. For example, for Phase 1, a minimum of 19 samples would be collected for every 152 m^3 of soil (Section 3.4.4.2).

3.4.2 Locating Samples

Systematic soil samples in trench surfaces, or on RSY pads, if used, will be located using the *Visual Sample Plan: A Tool for Design and Analysis of Environmental Sampling* (VSP; Pacific Northwest National Laboratory, 2014) software (or equivalent). Each SU will be mapped in VSP (or equivalent), such that at a minimum, 19 systematic soil samples will be collected in each SU. The systematic soil samples will be plotted using a random start triangular grid using VSP (or equivalent) with global positioning system (GPS) coordinates for each systematic sample.

3.4.3 Radiological Background

The ^{226}Ra RG presented in Table 5 is incremental concentration above background. For the other ROCs, analytical results will be compared to the RGs or background threshold values (BTVs), whichever is higher. The BTVs were established in the *Final Background Soil Study Report, Base Realignment and Closure Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California* (CH2M Hill Inc., 2020).

3.4.4 Phase 1 Trench Design

Radiological investigations will be conducted on a targeted group of 17 former trenches associated with the former SS/SD lines. The former trenches selected for Phase 1 investigation were based on the Navy assessment as to whether the previously collected radiological data can support a radiological unrestricted release recommendation, the Navy compiled soil and building data into comprehensive databases; evaluated the data by SU using logic and statistical tests; and made recommendations for additional sampling, retesting archived soil samples, or no additional sampling. The Navy's evaluation of the former SS/SD line system, building, and former building site surveys conducted by the contractor is presented in draft radiological data evaluation findings reports.

Table 3 lists the Phase 1 trenches and Figures 3 through 6 depicts the Phase 1 trenches. The Phase 1 trenches will be re-excavated to the previous excavation limits by making reasonable attempts to ensure accuracy in relocating the former trench boundaries. The excavated soil material will be investigated by gamma scan surveys and systematic and biased soil sample collection following either the automated soil sorting system (S3) process (Section 3.7.3.1) or the RSY process (Section 3.7.3.2). If the investigation results from the gamma scan surveys and results from the analysis of systematic and biased soil samples demonstrate potential exceedances of the RGs and background, the material will be segregated for further evaluation (Section 5.3).

To address the Phase 1 radiological investigations of the former trench sidewalls and floors, a strategy to not only excavate the former trenches to the previous excavation limits, but to over-excavate at least an additional 6 inches outside the estimated previous boundaries of the sidewalls and bottom will be employed. The exhumed over-excavated material will represent the trench sidewalls and bottom and will be gamma scan-surveyed and sampled ex situ, to provide the following benefits:

- Significant improvement of the measurement quality for gamma scan surveys by controlling the measurement geometry.
    - Prescribed material thickness
    - Use of large-volume sodium iodide (NaI) detectors with shielding
    - Use of large-volume NaI detectors with spectroscopy
- Reducing the potential safety risks associated with in situ trench sidewall and bottom scanning and sampling.
- Reducing the water management required to de-water trenches to provide unsaturated material to investigate.
- Increasing assurance that potentially impacted materials are investigated because of the inherent limitations of finding exact boundaries.

The over-excavated material (representing sidewalls and floors) will be investigated in the same fashion as the excavated soil by gamma scan surveys and soil sample collection by S3 process (Section 3.7.3.1) or RSY process (Section 3.7.3.2). The over-excavated material representing trench sidewalls and floors will be maintained as separate volumes (e.g., piles) of soil from the original excavated soil. Figure 7 shows a stylized graphic of an example Phase 1 trench. If the investigation results from the gamma scan surveys and results from the analysis of systematic and biased soil samples of the over-excavated material demonstrate exceedances of the applicable RGs and/or background, the material will be segregated for further evaluation. An in situ investigation of the trench sidewalls and floor will be performed (Section 5.3).

3.4.4.1 Nomenclature of Phase 1 Trench Units

The former trenches will be excavated and characterized in “batches” that will be given new unique identifiers at the time of excavation by the geologist or radiation technician. Excavated material representing the backfill material from former trenches will use the following nomenclature format:

AABB-ESU-NNNA

Where:

AA = facility (“HP” for Hunters Point)

BB = site location (“D2” for Parcel D-2)

ESU = excavation soil unit

NNN = former trench number

A = alpha numeric digit of each “batch” (beginning with A, in sequential order)

Excavated material representing the sidewalls and bottoms of former trenches will use the following nomenclature format:

AABB-SFU-NNNA

Where:

AA = facility (“HP” for Hunters Point)

BB = site location (“D2” for Parcel D-2)

SFU = sidewall floor unit

NNN = former trench number

A = alpha numeric digit of each “batch” (beginning with A, in sequential order)

3.4.4.2 Size of Phase 1 Trench Soil Batches

RSY pads are designed to be approximately 1,000 square meters (m^2). Using the assumption that material will be assayed in geometries yielding soil column thickness of 6 inches, the volume of a “batch” of excavated material (either ESU or SFU) is calculated as:

$$1000m^2 \times 0.1524m\ (6\ inches) = 152m^3$$

Therefore, an individual ESU or SFU volume will not exceed 152 m^3. Converting from m^3 to tons of soil (a more commonly used unit), the maximum “batch” size of excavated material will not exceed:

$$152m^3 \times \frac{1.3yd^3}{m^3} \times \frac{2{,}200lbs\ soil}{yd^3} \times \frac{1ton}{2{,}000lbs} \approx 217\ tons\ soil$$

This calculation assumes 2,200 pounds of loose soil per cubic yard, actual field conditions may vary from this assumption. Each former trench will be excavated and managed in no larger than approximately 152 m^3 “batches” and individually stockpiled prior to radiological screening. Using a maximum size of 152 m^3, Table 3 lists the estimated number of expected ESUs and SFUs. The actual sizes of individual ESUs and SFUs will be determined in the field, based on the actual field excavation limits and volumes of soil material excised from the former trenches.

3.4.5 Phase 2 Trench Design

Table 4 lists the Phase 2 trenches and Figures 3 through 6 depicts the Phase 2 trenches. Investigations of the Phase 2 trenches will consist of a combination of surface gamma scan surveys and soil samples.

Each Phase 2 trench will undergo a 100 percent radiological surface gamma scan of accessible areas using an appropriate instrument (Section 3.5). The instrument will be composed of a gamma scintillation detector coupled to a data logger that logs the count rate data in conjunction with location. Gross gamma and gamma spectra (if the RS-700 is used) obtained during the surface gamma scan surveys will be analyzed using region of interest (ROI) peak identification tools for the ROCs. Elevated areas will be noted on a survey map and flagged in the field for verification. Manual scans using a handheld instrument may be performed to further delineate suspect areas in the SU. Biased samples will be collected from potential areas of elevated activity displaying gamma scan survey results greater than the ILs (Section 5.3.1).

Within the backfill of each previous trench boundary, VSP (or equivalent) (Pacific Northwest National Laboratory, 2014) will be used to determine the systematic soil boring locations (Section 3.4.1). Figure 8 shows a stylized graphic of an example Phase 2 trench with 19 systematic boring locations placed on a triangular grid. Each location will be cored down to approximately 6 inches below the depth of the previous excavation. Each retrieved core will be scan-surveyed along the entire length of the core. Scan measurement results of the retrieved core will be evaluated to investigate the potential for small areas of elevated activity in the fill material. A sample will be collected from the top 6 inches of material, and a second sample will be collected from the 6 inches of material just below the previous excavation depth. Additionally, a third sample will be collected from the core segment with the highest scan reading that was not already sampled. At least three samples will be collected from each of the 19 borings, for a total of 57 samples per previous trench boundary. Table 4 shows the anticipated number of subsurface soil samples; however, additional locations or samples may be required based on the evaluation following analysis of RBA data.

In addition, systematic cores will be placed every 50 linear feet on each trench sidewall in order to collect samples from locations representative of the trench sidewalls. The systematic boring locations will be located approximately 6 inches outside of the previous sidewall excavation limits and will extend 6 inches past the maximum previous excavation depth on both sidewalls in every trench. In the same fashion described in the previous paragraph, core sections will be retrieved, scanned, and sampled such that at least three samples will be collected from each of the boring locations. Table 4 shows the projected number of borings and soil samples obtained from sidewall material. Figure 8 shows the typical sample locations representing the trench sidewalls. Section 3.7.4.1 details the subsurface soil sampling process. The soil samples will be submitted to the off-site analytical laboratory for analysis according to the SAP (Appendix B).

3.5 Instrumentation

Radiation instruments, consistent with *Basewide Radiological Management Plan, Hunters Point Shipyard, San Francisco, California* (TtEC, 2012a), have been selected to perform measurements in the field. Section 3.7 of this WP provides specifics related to radiological investigation implementation. The SAP (Appendix B) discusses the laboratory instruments used to analyze the soil samples and the associated standard operating procedures for calibration, maintenance, testing, inspection, and QA/QC.

3.5.1 Gamma Instruments

The gamma scanning survey instruments are selected to provide a high degree of defensibility and be based on their capability to measure and quantify gamma radiation and position using the best available technology. The primary gamma scanning instrument that will be used during Phase 2 trench surface scan surveys and soil scan surveys of excavated trench soil (either following the RSY or soil sorting processes) will consist of NaI or plastic scintillation detectors equipped with automated data logging, such as the RS-700 or a 3-inch-by-3-inch NaI detector. With the exception of the 3-inch-by-3-inch NaI detector, the gamma scan survey system will be equipped with gamma spectroscopy capabilities, providing the benefit of collecting spectral measurements in addition to the gross gamma measurements. The spectra will be evaluated using ROI-peak identification tools for the ROCs that correspond to gamma rays at 609 kiloelectron volt (keV) and 1,764 keV for ^{226}Ra daughter bismuth-214, 662 keV for ^{137}Cs, and a gross gamma window (i.e., full-energy spectrum). Section 3.5.1.1 provides details on the evaluation of ROIs and gross gamma windows for the RS-700 system.

The gamma scanning instrument will be equipped with a positioning sensor and software that is able to simultaneously log continuous radiation and position data. The gamma radiation measurement will be coupled to the position measurement to allow for precise visualization of the data set (for example using Arc geographic information system software), for both RS-700 gamma walkover data and the 3-inch-by-3-inch NaI gamma walkover data. For gamma scan surveys of retrieved cores, a 3-inch-by-3-inch NaI detector will be used.

The asphalt covering the trenches is considered non-impacted. As a conservative measure, the 3-inch-by-3-inch NaI detector will be used to scan the top of the asphalt. Once cut, the asphalt will be turned over and the underside will also be gamma scanned. Locations that exceed the instrument-specific asphalt investigation limit will be investigated with biased static measurements.

The RS-700 system is composed of two 4-liter NaI detectors. The detectors are mounted end-to-end lengthwise with a gap of approximately 4 inches between the detectors. The detectors are maintained at a constant distance above the ground of approximately 15.24 centimeters (cm), with each pass offset such that the detector path overlaps the previous detector pass by approximately 10 to 12 inches to ensure complete gamma scan coverage.

Excavated soil may also be radiologically surveyed on the automated S3. The instruments that may be used during fieldwork include:

- Radiation Solutions, Inc. RS-700—uses two 4-liter NaI detectors, for ex situ RSY and soil area gamma scan surveys
- Ludlum Model 2221, coupled with a Ludlum Model 44-20—a 3-inch-by-3-inch NaI detector, for soil area gamma scans, sample screening, and soil core surveys
- Automated S3—a large-volume NaI detector, for gamma scan surveys of excavated soil
- For gamma scan surveys conducted on the Phase 2 trench surfaces, or in the RSY pads if used, the gamma scanning instrument will also be equipped with a positioning sensor and software that is able to simultaneously log continuous radiation and position data. The gamma radiation measurement will be coupled to the position measurement to allow for precise visualization of the data set. For gamma scan surveys of retrieved cores, a gamma instrument consisting of a NaI detector will be used.

3.5.1.1 RS-700 Gamma Scan Analysis

The data collected during the gamma scan using the RS-700 system are evaluated through a tiered approach during data review for the RS-700 system data to identify areas requiring additional surveys and biased samples, as described in the second stage of the gamma count rate surveys. Ten ROIs have been established for radium and progeny as well as other naturally-occurring or anthropogenic gamma-emitting radionuclides that may be of interest. Three virtual detectors (VDs) are set up in the analysis software (RadAssist). VD1 denotes both detectors summed, VD3 refers to the left detector, and VD4 refers to the right detector.

First the data file is replayed in RadAssist and reviewed for elevated count rates in several relevant ROIs. Next, the count rates for several relevant ROIs are plotted in a time series and reviewed for additional peaks. The Z-scores are calculated for each location in ROIs for VDs 1, 3, and 4. Local Z-scores are also calculated using a moving average to identify elevated count rates where the background is variable, for SUs that meet this criterion. Semi-local Z-scores are calculated using the global average but with a moving average for the standard deviation to identify smaller areas of elevated count rates that may not be otherwise identified by the initial Z-score review for SUs that meet this criterion. Locations with four or more ROIs with a Z-score, local Z-score, or semi-local Z-score greater than 3 is marked for follow-up

These three types of Z-scores are also plotted in a time series and reviewed for additional peaks in Z-score. Finally, count rate ratios are calculated for key ROIs and reviewed for obvious peaks or outliers.

3.5.2 Instrument Detection Calculations

The equations to calculate efficiencies, MDCs, and minimum detectable count rates (MDCRs) for handheld and mobile gamma detectors at HPNS are based on the methodology and approach used in MARSSIM (Chapter 6) (EPA et al., 2000) and *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG/CR-1507 (NRC, 1998) (Chapter 6). The instrument equations in this subsection may be used to calculate adjustments if the changes are approved in writing by a Certified Health Physicist before initial use. Appendix H provides MDCs for the S3. The following subsections provide calculation examples intended to illustrate the calculation approach.

3.5.2.1 Gamma Surface Activity

Estimating the amount of radioactivity that can be confidently detected using field instruments is performed by adapting the methodology and approach used in MARSSIM Section 6.7.2.1 (EPA et al., 2000) and *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG/CR-1507 (NRC, 1998) (Section 6.8.2) for determining the gamma scan MDC for photon-emitting radionuclides.

The scan MDC (in pCi/g) for land areas is based on the area of elevated activity, depth of contamination, and the radionuclide (energy and yield of gamma emissions). The computer code MicroShield can be used to model expected exposure rates from the radioactive source at the detector probe NaI crystal and includes source-to-detector geometry. The geometry is used to calculate the total flow of photons incident upon the detector crystal, called the gamma fluence rate, ultimately corresponding to an exposure rate that is associated with a count rate in the instrument.

The amount of radiation the detector crystal is exposed to from the modeled source is used to determine the relationship between the detector's net count rate and the net exposure rate (count per minute [cpm] per microroentgen per hour [µR/hr]).

3.5.2.2 Gamma Scan Minimum Detectable Concentration

The general assumptions and modeling inputs are as follows:

- Ambient background count rate of 18,000 cpm, based on the general observed average count rate from a Treasure Island reference area.
- Average background count rate of 3,767 counts per second (the per-detector average) for the RS-700, equal to 226,018 cpm, based on the observed average count rate for the RS-700 from a Treasure Island reference area.

- Count rate to exposure rate ratio of 2,300 cpm per µR/hr for ^{137}Cs (manufacturer's reported ratio for Ludlum Model 44-20 3-inch-by-3-inch NaI detector).
- Estimated count rate to exposure rate ratio of 42,483 cpm per µR/hr for ^{137}Cs (based on observation of 226,018 cpm in a 5.32 µR/hr field) for the RS-700.
- Length of the 3-inch-by-3-inch NaI parallel to the surveyed surface is equal to 3 inches (7.6 cm).
- Length of the RS-700 detector parallel to the surveyed surface is equal to 4 inches (10.16 cm).
- For scans using the 3-inch-by-3-inch NaI detector, level of performance (d') is equal to 1.38, corresponding to 95 percent true positive detection rate and 60 percent false positive detection rate—for the 3-inch-by-3-inch NaI detector a higher false positive detection rate is acceptable as the technician performing the scanning surveys will have the flexibility to investigate audible or visible changes in count rate (i.e., conduct "second stage scanning," per MARSSIM [EPA et al., 2000]).
- For scans using the RS-700, level of performance (d') is equal to 3.28, corresponding to 95 percent true positive detection rate and 5 percent false positive detection rate—for the RS-700 a lower false positive detection rate is desired as the size and mobility of the system will limit the technician's ability to investigate anomalous measurements in real time.
- The thickness of the aluminum housing for the 3-inch-by-3-inch NaI detector is 0.02 inches (0.051 cm), with a density of 2.7 grams per cubic cm (g/cm^3).
- The thickness of the carbon fiber and foam casing of the RS-700 detector is modeled as a 0.125-inch (0.318 cm) carbon layer with a density of 2.27 g/cm^3. The aluminum covering for the NaI crystal is 0.02 inches (0.051 cm), with a density of 2.7 g/cm^3.
- Scan speed for the 3-inch-by-3-inch NaI detector is 0.5 meters per second (m/s), resulting in an observation interval of one second.
- The scan speed for the RS-700 is 0.25 m/s, resulting in an observation interval of two seconds.
- Surveyor efficiency of 0.50 for the 3-inch-by-3-inch NaI detector .
- Surveyor efficiency of 0.9, increased from a default of 0.5 based on the constant surveyor speed, data logging, mapping, and spectral analysis features of the RS-700 system.

The following equations are used in the calculation of gamma scan MDCs (detailed calculations are found in Appendix G for both detectors and ROCs):

Calculation of MDCR and MDCR$_{Surveyor}$

$$s_i = d'\sqrt{b_i}$$

$$MDCR = s_i \times (60/i)$$

$$MDCR_{Surveyor} = \frac{MDCR}{\sqrt{p}}$$

Where:

d' = measurement performance parameter, determined from desired true positive and false positive rates from MARSSIM Table 6.5 (EPA et al., 2000), unitless, equal to 1.38

b_i = number of background counts observed during observation interval *i*, in counts

s_i = number of source counts required for a specified level of measurement performance and observation interval *i*, in counts:

MDCR = minimum detectable count rate, in cpm

$MDCR_{Surveyor}$ = minimum detectable count rate accounting for surveyor efficiency, in cpm

P = surveyor efficiency, equal to 0.5

Calculation of the Fluence Rate to Exposure Rate

$$Fluence\ Rate\ to\ Exposure\ Rate \approx \frac{\left(1\frac{\mu R}{hr}\right)}{E_\gamma\left(\frac{\mu_{en}}{\rho}\right)_{air}}$$

Where:

E_γ = Gamma energy in keV

$(\mu_{en}/\rho)_{air}$ = Mass energy absorption coefficient for air, in units of square cm (cm^2) per gram. Values were obtained from *Radiological Health Handbook* (U.S. Department of Health, Education, and Welfare, 1970).

Calculation of Probability of Interaction Through the Detector

$$Probabilty\ of\ Interaction\ (P) = 1 - e^{-\left(\left(\frac{\mu}{\rho}\right)_{NaI}(x)(\rho_{NaI})\right)}$$

Where:

P = Probability of gamma interaction with the NaI crystal

$(\mu/\rho)_{NaI}$ = Mass attenuation coefficient for NaI, in units of cm^2 per gram. Values were obtained from *Radiological Health Handbook* (U.S. Department of Health, Education, and Welfare, 1970).

x = Length of detector parallel to surveyed surface, equal to 7.6 cm

ρ_{NaI} = Density of NaI, equal to 3.67 g/cm^3

Calculation of Relative Detector Response

$$RDR = FRER \times P$$

Calculation of the Total Energy-Weighted cpm/μR/hr Ratio

$$weighted\left(cpm/\tfrac{\mu R}{hr}\right) = \sum\left(\frac{\dot{X}_{E_i}}{\dot{X}_{Total}} \times \frac{cpm}{\mu R/_{hr}}, E_i\right)$$

Calculation of the Exposure Rate at the $MDCR_{Surveyor}$ and Scan MDC

$$\dot{X}, MDCR_{Surveyor} = \frac{MDCR_{Surveyor}}{weighted\left(cpm/\frac{\mu R}{hr}\right)}$$

$$Scan\ MDC\left(\frac{pCi}{g}\right) = Modeled\ Conc. \times \frac{\dot{X}, MDCR_{Surveyor}}{\dot{X}_{Total}}$$

Table 6 presents a summary of the gamma scan MDCs for ^{226}Ra and ^{137}Cs. The MDCs will be recalculated when site- and instrument-specific data are available, prior to the beginning of field activities.

3.5.3 Calibration

Survey instrument calibration is completed annually, or every two years for the RS-700. Instrument calibration is also performed after repairs or modifications have been made to the instrument. The instruments will be calibrated in accordance with the manufacturer's recommended method.

3.5.4 Daily Performance Checks

Prior to use of the radiological survey instruments, calibration verification, physical inspection, battery check, and a source response QC check are performed daily in accordance with AMS-710-07-PR-04013, "Radiation Detection Instrumentation" (APTIM, 2020b), AMS-710-07-WI-40141, "Operation and Use of Portable Instruments" (APTIM, 2020b), and other applicable procedures.

Physical inspection of the portable survey instrument will include the following:

- General physical condition of the instrument and detector before each use
- Knobs, buttons, cables, connectors
- Meter movements and displays
- Instrument cases
- Probe and probe windows
- Other physical properties that may affect the proper operation of the instrument or detector

Portable survey instruments or detectors with a questionable physical condition will not be used until problems have been corrected. A battery check will be performed to ensure that sufficient voltage is being supplied to the detector and instrument circuitry for proper operation. This check will be performed in accordance with the instrument's operations manual. The instrument will be exposed to the appropriate (alpha, beta, gamma) check source to verify that the instrument response is within the plus or minus 20 percent range determined during the initial response check. The calibration certificates and daily QA/QC records for each instrument used and the instrument setup test records will be provided in the project report. If portable survey instruments, or instrument and detector combinations, with a questionable physical condition that cannot be corrected fails the operation check, or exceeded its annual calibration date without Project Radiation Safety Office (PRSO) approval, the instrument will be put in an "out of service" condition. This is done by placing an "out of service" tag or equivalent on the instrument and securing the instrument or the instrument and detector combination in a separate area such that the instrument or instrument and detector combination cannot be issued for use. The PRSO and radiological control technician and their respective supervisors will be notified immediately when survey instrumentation has been placed "out of service." Instruments tagged as "out of service" will not be returned to service until deficiencies have been corrected. The results of the daily operation checks, previously discussed, will be documented.

3.6 Debris Screening

Debris (larger than two inches) will be mechanically screened and segregated in accordance with APTIM work instructions. Large debris is not anticipated because this project includes re-excavating backfilled material. Segregated debris will be surveyed for gamma radiation to verify the absence of attached or embedded low-level radiological objects and for loose surface alpha and beta radioactivity consistent with APTIM work instruction D2006-4550-010, "Radiological Survey of Oversize Debris."

Debris screening will include gamma scanning of 100 percent of the segregated debris and alpha/beta surface contamination surveys of approximately 25 percent of the segregated debris to support characterization of the segregated debris as low-level radioactive waste (LLRW) and/or non-LLRW. Handheld gamma survey instrumentation (Ludlum Model 2221 with Ludlum Model 44-20 NaI detector, or equivalent) ILs will be developed as previously described. Alpha/beta survey instrumentation MDCs will be developed in accordance with Section 4.0. Debris will be managed in accordance with the waste management plan (Section 7.0).

3.7 Radiological Investigation Implementation

This subsection provides guidance on the implementation of radiological investigations for soil.

3.7.1 Premobilization Activities

Before initiating field investigations, several premobilization steps will be completed to ensure that the work can be conducted in a safe and efficient manner. The primary premobilization tasks include training of field personnel and procurement of support services.

A list of the various support services that are anticipated to be required are as follows:

- Radiological analytical laboratory services
- Drilling subcontractor
- CA licensed surveying subcontractor
- Utility location subcontractor
- Vegetation clearance subcontractor
- Transport (trucking) subcontractor

3.7.1.1 Training Requirements

Non-site-specific training required for field personnel will be performed before mobilization to the extent practical. Section 6.0 outlines training requirements.

Medical examinations, medical monitoring, and training will be conducted in accordance with the APP/SSHP (APTIM, 2019a) and Section 6.0.

In addition to health and safety-related training, other training may be required as necessary including but not limited to the following:

- Aerial lift (personnel working form aerial lifts)
- Fall protection (personnel working at heights greater than 5 feet)
- Equipment as required (e.g., fork lift, skid steer, loader, back hoe, excavator)

3.7.1.2 Permitting and Notification

Before initiation of field activities for the radiological investigation, the contractor will notify the Navy Remedial Project Manager (RPM), Resident Officer in Charge of Construction (ROICC), Radiological Affairs Support Office (RASO), and HPNS security as to the nature of the anticipated work. Required permits to conduct the fieldwork will be obtained before mobilization. The contractor will notify the California Department of Public Health at least 14 days before initiation of activities involving the Radioactive Materials License.

3.7.1.3 Pre-construction Meeting

A pre-construction meeting will be held before mobilization of equipment and personnel. The purpose of the meeting will be to discuss project-specific topics, roles and responsibilities of project personnel, project schedule, health and safety concerns, and other topics that require discussions before field mobilization. Representatives of the following will attend the pre-construction meeting:

- Navy (RPM, RASO, ROICC, and others as applicable)

- Contractor (Project Manager, Site Construction Manager, Project QC Manager, PRSO, and Site Safety and Health Officer [SSHO])
- Subcontractors as appropriate

3.7.2 Mobilization Activities

Mobilization activities will include site preparation, movement of equipment and materials to the site, and orientation and training of field personnel.

At least two weeks before mobilization, the appropriate Navy personnel, including the Navy RPM and ROICC and Caretaker Site Office, will be notified regarding the planned schedule for mobilization and site remediation activities. Upon receipt of the appropriate records and authorizations, field personnel, temporary facilities, and required construction materials will be mobilized to the site.

The temporary facilities will include restrooms, hand-washing stations, and one or more secure storage (Conex) boxes for short- and long-term storage of materials, if needed.

The applicable activity hazard analysis (AHA) forms will be reviewed prior to starting work.

Equipment mobilized to the site will undergo baseline radioactivity surveys (Section 6.0). Surveys will include direct scans, static measurements, and swipe samples. Equipment that fails baseline surveying will be removed from the site immediately.

3.7.2.1 Locating and Confirming Boundaries

The first step to begin the radiological investigations is locating and marking the boundaries of the former trenches. This will be accomplished by using best management practices (BMPs) to identify boundaries and depths of the former trenches based on the previous TtEC reports (e.g., survey reports, drawings, sketches), field observations (such as GPS locations from geo-referencing, borings, and visual inspection), and durable cover as-built records. Once the boundaries are located, the areas will be marked in the field with paint or pin flags.

3.7.2.2 Site Preparation

After the boundary location and mark-outs are completed, the following steps will be implemented to prepare the site for investigation and facilitating access.

- A radiologically controlled area (RCA) will be established around work areas and delineated with temporary fencing, caution tape, or equivalent, and have the appropriate warning signage posted. Access control points will be established a maintained. Radiological screening of personnel, equipment, and materials will be required when exiting the RCA. The RCA will be posted consistent with APTIM requirements. Routine surveys and inspections will be performed along the fence line, consisting of dose rate measurements and visual inspections surveys will be performed to ensure that there is no change in dose readings in accessible areas that could negatively affect the public or environment. Breaches in the fence during site activities will be repaired.

- Stormwater, sediment, and erosion control measures will be implemented to prevent soil from entering or leaving the site as detailed in the environmental protection plan.
- Dust control methods and air monitoring will be implemented during intrusive activities as detailed in the environmental protection plan.
- An independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions will be performed by a third-party utility locator subcontractor following a review of existing utility drawings of the affected areas. The survey will be conducted over the known or suspect areas where underground utilities may exist using ground-penetrating radar or electromagnetic instrumentation. Underground Service Alert will be contacted at least 72 hours before initiating intrusive activities. The results of the geophysical survey will be compared to the available historical drawings and combined with Underground Service Alert markings (if any) to identify locations of underground utilities. Additionally, a visual survey of the area to validate the chosen location will also be conducted. Colored marking paint (or stakes or equivalent) will be used to mark identified utilities (if any) within the proposed work area. A minimum of 2 feet from the closest utility will be maintained to prevent accidental exposure to the utility, based on the utility hazard or importance. Utility lines encountered will be assumed active, unless specifically determined to be inactive through consultation with the subject utility company and with the Navy Caretaker Site Office representative, ROICC, and RPM.
- For both Phase I and Phase 2 trenches, the asphalt cover will be removed to expose the target soil. Because of the inherent difficulty expected to determine the exact horizontal boundaries of the previous excavation, to provide access to the trench, and to account for regrading, an additional 1 foot of asphalt material on both sides of the historical trench excavation boundary will be removed to allow for a sufficient buffer for excavation of trench materials (Phase 1 trenches) and access for the surface gamma scan (Phase 2 trenches). After the asphalt cover is removed, attempts will be made to confirm the delineation between fill materials and native soil by reviewing cut-and-fill drawings and visual inspections.
- Durable cover materials, listed above, will require release surveys prior to off-site disposal. Release surveys of the materials will be performed.

3.7.3 Phase 1 Trench Investigation

Once site preparation activities previously described are completed, trench investigation activities will commence.

Each former Phase 1 TU will be excavated to the original excavation limits and evaluated in approximately 152 m^3 ESUs. The excavated material will then undergo radiological assay following either the automated soil sorting process or RSY pad process, as described in the following subsections. One hundred percent of the Phase 1 ESU soil will undergo scan surveys using real-time gamma spectroscopy equipment in the soil sorting process or the RSY pad process. Section 3.5 details the scanning instrumentation.

Once the excavation to the original excavation limits has been completed, over-excavation of at least an additional 6 inches outside the estimated previous boundaries of the sidewalls and bottom will be initiated. This exhumed over-excavated material (SFU) will be maintained separate from the backfill volumes (ESU) and will represent the trench sidewalls and bottom. The over-excavated material (SFUs) will be investigated in the same fashion as the excavated soil (ESU) methodology by gamma scan surveys and soil sample collection (S3 process or RSY process). Following completion of scanning activities, the ESU and SFU material will either be returned to the same trench that the material originated from or will be segregated for further investigation.

3.7.3.1 Automated Soil Sorting System Process

Excavated TU materials will be transported to a soil sorting area for processing. Processing activities using automated soil sorting technology include gamma surveys using large-volume gamma spectroscopy detectors to monitor multiple isotopes simultaneously (including ^{226}Ra and ^{137}Cs), systematic and biased sampling and analyses, performing investigation activities (as necessary), radiologically clearing the materials for either reuse or disposal and transport of the materials out of the soil sorting area.

More details about the operation and methodology used by the S3 is provided in the soil sorting operation plan (Appendix H).

Transfer of Excavated Soil for Processing

Excavated trench materials will be transported to the soil sorting area by dump truck or other conventional means. Excavated soil entering the soil sorting area must be accompanied by a truck ticket (paper or digital) to facilitate transfer of the material for radiological processing. This ticket will provide the soil sorting staff with the following information:

- Location of excavation, including former trench name
- From which trench sidewall or floor surface material was excavated (if applicable)
- Load number
- Estimated volume of soil
- Date and time of excavation

The material will be collected into individual 152 m^3 batches, as described in the following subsections, taking care to differentiate between the original trench boundary excavation (ESUs) and over-excavation of trench floors and sidewalls (SFUs). The soil sorting personnel will instruct the soil transport driver where to place the material for subsequent processing through the S3.

General Process

The S3 conveyor system is a radiological soil screening system designed to perform real-time segregation of soil into two distinct bins based upon its radiological properties. The system is capable of processing and segregating large volumes of soil with relatively high throughput rates. Commercially available material conveyors are used to physically manage the soil. These conveyors prepare and condition material, they transport the material past the monitoring devices (various radiation detectors), and they provide the physical means to sort material.

The material is sorted into two distinct bins (piles), commonly referred to as the “Below Criteria” and “Diverted Pile” bins. The basis upon which the soil material is sorted and segregated into distinct volumes is controlled by the establishment of “diversion control setpoints” that automatically trigger the diverting mechanism, sorting the material into the appropriate bin. The selection of the system’s diversion control setpoints depends on a number of factors and will ultimately be chosen and described in the soil sorting operation plan (Appendix H). At a minimum, diversion control setpoints will sort soil at the ILs listed (Section 3.3.1) and will divert radiological commodities (such as deck markers, if encountered). Soil diverted to the “Diverted Pile” bin will be investigated as a potential area of elevated activity (Section 5.3.2).

Soil stockpiles (ESUs or SFUs) consisting of either former trench fill material or trench sidewalls and bottom materials with a maximum size of 152 m^3 will be staged near the S3. Using typical earth moving equipment (i.e., front-end loader or excavator) soil will be fed to the S3. If necessary, the material may be processed through a trammel to condition the soil to flow through the conveyor-based system. Once the soil reaches the primary assay conveyor, the material will pass under a fixed strike-off plate (or equivalent) to ensure that the thickness of the material does not exceed 6 inches. The material will move past the active area of the detectors, and the system’s software will interpret the spectroscopy data to determine whether the volume of soil exceeds the specified alarm points. As the material continues to travel up the conveyor, it is automatically sorted in one of two bins. Figure 9 shows the typical soil sorting layout.

The following operating parameters are expected for the S3, any changes to these parameters will be communicated to the Navy:

- Survey belt speed will not exceed 6 inches per second
- System will be equipped with eight large-volume gamma detector (e.g., 3-inch-by-5-inch-by-16-inch NaI)
- Soil thickness on the belt will be set to 2 inches.

Following completion of an ESU or SFU batch, the radiological results will be generated using soil sorting reporting software. Reports will include the basic statistical metrics for each of the two bins of soil that were created including the mean, median, min, max, and standard deviation of the gamma-emitting ROCs.

Soil Sampling and Follow-up Activities

The ultimate compliance with the respective RAOs is demonstrated by collecting and analyzing soil samples for the applicable ROCs. Eighteen systematic soil samples (Section 3.4.1) will be collected from each ESU and SFU during assay with the S3. In the case of soil sorting, systematic samples will be collected at a given time period, the frequency of which is determined to provide a systematic distribution of sample collection throughout each ESU or SFU. For example, if the S3 is configured to process a 152 m^3 batch in three hours, a systematic sample will be collected every 9.5 minutes (180 minutes/19 samples = 9.5 minutes). Samples will be collected from material moving through the soil sorter before discharge.

If soil material has been discharged to the “Diverted Pile,” an investigation of the potential area of elevated activity (i.e., the “Diverted Pile” material) will be conducted. At a minimum, the soil sorting reporting software results will be reviewed to identify the causes for diverting material, and biased samples will be collected. Biased soil samples will be collected from the belt prior to diversion (i.e., the belt will be stopped and material sampled directly off the belt). Biased samples may also be collected from the soil discharged to the diverted material bin. Biased samples will be collected at a minimum frequency equal to the volumetric frequency of sampling for a SU, ESU or SFU batch, in accordance with the project WP procedures. As required to appropriately characterize the soil, soil samples may be collected at each diversion at a maximum volumetric frequency of approximately 1 sample per 3 cubic feet (i.e., typical volume of smallest diversion), depending on the volume of diverted soil. The biased sample will be collected from the area exhibiting the most elevated counts to the extent practicable.

Using the current minimum number of systematic samples in a given ESU or SFU (19), with a maximum size of 152 m^3, a sample will be collected roughly every 8 m^3, with a minimum of at least one sample being collected if the volume is less than 8 m^3. Additionally, if the soil material discharged to the “Diverted Pile” originates from an SFU and is confirmed to contain contamination, an in situ investigation of the open trench will be performed at the excavation location of the soil. Material discharged to the “Diverted Pile” will remain segregated until completion of the investigation activities. The trench under investigation will remain open until investigation and remediation activities are completed. If necessary, additional samples may be collected from diverted material to support characterization for waste disposal.

Soil processed by the S3 and subsequently staged for off-site disposition or on-site reuse will be staged pending evaluation of off-site analytical results and Navy approval for disposition or reuse.

Soil pending off-site analytical results may be staged in stockpiles smaller than 152 m^3, which would permit the re-evaluation of smaller soil volumes should elevated soil sample results be received from the off-site laboratory.

If elevated sample results are identified by off-site analysis, the contractor will notify the Navy and determine a suitable soil rescreening process, either by RSY pad or by the soil sorter. SFU sampling locations with results that exceed the RGs and background will be remediated by additional soil excavation

Mobilization, Setup, and Calibration

The system will be set up and configured at a suitable location with respect to accessibility, while not impacting load paths for heavy excavation equipment. Before setup, the area where the system will be operated will be radiologically scan-surveyed to document the existing conditions.

Dust management practices will be used during soil sorting operations to minimize potential dust (Appendix E). Additional practices including adding wind panels to shield against winds that may create dust from the initial loading process, equipping discharge chutes with shrouds, in-line misting systems, dust mist oscillation cannons, and sorting under an enclosure may be used as necessary. The usage of an enclosure, if deemed appropriate, would require a tent approximately 25 feet by 50 feet. The final dust management practices will be finalized before mobilization of the system and may be modified during operations as required.

Quality Assurance and Quality Control

The automated S3 will adhere to strict QA/QC measures, to ensure accurate assay of the soil. The specific performance and documentation of the QA/QC measures will be included in the soil sorting operations plan (Appendix H).

3.7.3.2 Radiological Screening Yard Pad Process

If a conveyor-based automatic S3 process is not selected, excavated trench material will be assayed using the previously applied RSY process. Excavated trench materials will be transported to an RSY pad and spread approximately 6 to 9 inches thick for processing. Processing activities in the RSY pads include gamma scan surveys using a large-volume gamma scintillator equipped with spectroscopy, systematic and biased sampling and analyses, performing investigation activities (as necessary), radiologically clearing the materials for either reuse or disposal, and transport of the materials off the RSY pads. The objective of the processing activities on the RSY pads is to characterize the material. Material whose sample results meet the applicable RGs and/or background limits (Table 5) will be used as backfill material or shipped off site as non-LLRW. Before initiating excavation activities at each trench, existing RSY pads will be identified for use or new pads will be constructed. Transport routes between the trench and selected RSY pads will be established and approved by the Navy before initiating excavation activities at each trench.

Construction of Radiological Screening Yard Pads

If no existing RSY pads are available for use, pads will be constructed. RSY pads will be constructed with a size limit of 1,000 m^2. Prior to constructing the pad, a gamma scan and appropriate gamma static survey will be conducted of the underlying ground surface to establish a baseline and to determine if there is radiological contamination present. If the baseline gamma scan and gamma static survey of the ground surface identifies areas where the count rate exceeds the instrument-specific IL, the area will be flagged. Flagged areas will be further invested by a spectral analysis using the RS-700, or equivalent, or by soil sampling, if the ground surface is soil. If results indicate ROC concentrations above the critical level (for spectral analysis) or release criteria (for soil samples), appropriate remediation or relocation of the RSY pad may be necessary and will be determined in consultation with RASO. Once the RSY area has been cleared of potential material generating elevated gamma scanning measurements, the RSY pad will be constructed and surveyed as follows:

- Area will be covered with 10-mil plastic sheeting (or equivalent).
- Perimeter of the RSY pads will be bermed with hay bales (or equivalent) to prevent run-on and run-off during precipitation events.
- If the existing surface is uneven and/or consists of materials with different radiological characteristics (e.g., soil and asphalt), a 6-inch-thick buffer of clean import fill, and/or rock (or equivalent) will be laid across the plastic. The buffer material will be visually inspected to ensure it is free of debris/organic matter and of sufficient clay content to be readily compactable. If the existing surface is even and consists of similar materials, a buffer layer will not be used.
- If used, the buffer soil layer will be compacted via a minimum of four passes with an excavator or similar tracked machine. This will prevent damage to the plastic sheeting when the excavated soil is added or removed.
- Baseline radiological survey of the constructed RSY pad will be performed prior to the initial placement of excavated soil. After the baseline survey of the buffer soil (if required), plastic sheeting will be placed on the buffer soil later to prevent cross-contamination from the placement of excavated soil.
- A post-use gamma scan survey will be performed following removal of the RSY screened soil, and again following removal of the RSY pad itself, to verify that cross-contamination of the buffer soil and the underlying surface did not occur. If the gamma scan survey confirms that no cross-contamination occurred, the buffer soil may be disposed as non-contaminated material or may be reused elsewhere at HPNS with RASO concurrence.

Transfer of Excavated Soil for Processing

Excavated trench materials will be transported to the RSY pad by dump truck or other conventional means. Excavated soil entering an RSY must be accompanied by a truck ticket (paper or digital), to facilitate transfer of the material for radiological processing along a designated truck route. This ticket will provide the RSY staff with the following information:

- Location of excavation, including former trench identifier
- From which trench sidewall or floor surface the material was excavated (if applicable)
  - Tracked as ESU or SFU soil.
- Load number
- Estimated volume of soil
- Date and time of excavation

RSY personnel will direct the driver to the appropriate RSY pad for soil placement. The truck ticket will be amended with the assigned unique RSY pad number for tracking purposes. Placement of soil on an RSY pad will continue until the soil placed on the RSY pad reaches capacity as identified by the RSY support personnel and is ready for processing.

Each individual 152 m^3 trench stockpile will be loaded into the RSY pad, spread out, and leveled to a maximum depth of 6 or 9 inches for investigation.

- 6-inch soil depth (maximum) is permitted for gamma surveys planned to be performed with the Ludlum Model 2221/44-20 NaI detector
- 9-inch soil depth (maximum) is permitted for gamma surveys planned to be performed with the RS-700

General Process

The RSY process will include gamma scans over 100 percent of the surface area followed by systematic and biased soil sampling. A minimum of 19 systematic soil samples (Section 3.4.1.) will be collected from each pad along with biased samples, if needed, based on the results of the gamma scan and follow-up static surveys. Consistent with Section 3.4.1, a minimum of one biased sample will be collected from each ESU or SFU.

Gamma scans of the spread soil will be performed using a GPS coupled to an appropriate gamma scintillation scanning system (Section 3.5). The RS-700 gamma detection system (or equivalent) is designated as the primary gamma scanning instrument.

Using the RS-700 system, the scans will be performed by scanning straight lines at a rate of no more than 0.25 m/s with a consistent detector distance from the soil surface (approximately 4 inches above the surface). Generally, RSY pad lift will be gamma scanned as follows (the following description assumes the RSY area is positioned such that the sides align with north, south, east, west directions):

- Begin with the detector positioned in the southwest corner of the RSY pad at a height of approximately 4 inches above the surface. Orient the system to face north and initiate data collection (detector is automatically logging radiation readings and GPS is automatically logging position readings) so that the system is recording at a rate of one reading per second (or other, as determined by the project health physicist).
- Move the detector in the north direction at a speed no greater than 0.25 m/s.
- Once the detector reaches the edge of the pad, turn the system around (now facing south) and offset such that the detector path overlaps the previous detector pass by approximately 10 to 12 inches to ensure complete gamma scan coverage.
- Move the detector in the southern direction at a speed no greater than 0.25 m/s.
- Repeat these steps until the soil on the RSY pad area has been scan-surveyed.

The data collected during the gamma scan using the RS-700 will be evaluated (Section 3.5.1.1). If gamma scan surveys indicate areas of potentially elevated activity in soil above the ILs (Section 3.3.1), an investigation of the potential area of elevated activity will be initiated. At a minimum, the contractor will further evaluate the gamma scan data and collect gamma static follow-up measurements and/or biased soil samples. A biased soil sample will be collected from the location of any elevated gamma static follow-up measurement. If areas displaying elevated activity are collocated, an attempt will be made to locate the area with the highest gamma scan results and designate it as the biased sample location to represent the collocated elevated areas. Material with potentially elevated concentrations will remain segregated until completion of the investigation activities. Additionally, if soil sampling indicates areas of potentially elevated soil above the RGs and it is confirmed that the soil contains contamination, and if the soil material originates from an SFU, an in situ investigation of the open trench will be performed at the excavation location of the soil (Section 3.6.3.1).

Each 1,000 m^2 RSY pad area will be plotted using VSP (or equivalent) (Pacific Northwest National Laboratory, 2014) to determine the location of the 19 systematic soil samples. The systematic soil samples will be plotted using a random start triangular or square grid using the VSP (or equivalent). Soil samples will be collected from the surface at a depth of 0 to 6 or 0 to 9 inches, depending on gamma scan instrumentation utilized. Section 3.4.2 provides the technique for locating systematic samples. Soil samples will be containerized and submitted to an off-site laboratory with appropriate chain-of-custody documentation (SAP [Appendix B]).

Soil processed by the RSY process and subsequently staged for off-site disposition or on-site reuse will be staged pending evaluation of off-site analytical results and Navy approval for disposition or reuse. If elevated sample results are identified by off-site analysis, the contractor will notify the Navy and determine a suitable soil rescreening process, either by RSY pad or by the soil sorter. SFU sampling locations with results that exceed RGs and background will be remediated by additional soil excavation.

Following completion of scan surveys, sampling, and potential investigation activities, the excavated material will be returned to the same trench that the material originated from.

3.7.4 Phase 2 Trench Investigation

Investigations of the Phase 2 trenches will consist of a combination of gamma scan surveys and soil samples.

Gamma scan surveys of the surface soil will be performed using one or a combination of the gamma detectors listed (Section 3.5.1) (or equivalent). The scan surveys will generally be performed using the same protocols and methods as those in the RSY pads. Of the accessible surface of the Phase 2 trenches, 100 percent will be gamma scan-surveyed using a GPS coupled to a large-volume gamma scintillator, equipped with real-time gamma spectroscopy and data logging.

Data sets will be transferred from the data logger onto a personal computer to create spreadsheets and to map the gamma scan survey results. Data obtained during the surface gamma scan surveys, including gross gamma and individual radionuclide spectral measurements, will be analyzed to identify areas where surface radiation levels appear to be greater than the radionuclide-specific ILs using ROI-peak identification tools.

If gamma scan surveys indicate areas of potentially elevated activity in soil (Section 3.5.1.1), an investigation of the potential area of elevated activity will be initiated. At a minimum, the contractor will further evaluate the gamma scan data and collect biased soil samples. The biased soil sample will be collected from the approximate location of the highest elevated gamma scan survey measurement. If areas displaying elevated activity are collocated, an attempt will be made to locate the area with the highest gamma scan results and designate it as the biased sample location to represent the collocated elevated areas.

The systematic boring locations will be cored down to approximately 6 inches below the depth of the previous excavation within each trench boundary. Soil samples will be collected (Section 3.7.4.1). Sanitary sewer and SD lines were sometimes installed on bedrock. In these situations, sampling of bedrock will not be performed. If refusal is encountered within 6 inches of the expected depth of the trench, the soil sample will be collected from the deepest section of the core. If refusal is encountered more than 6 inches above the expected depth of the trench, the sample location will be moved to avoid the subsurface obstruction.

To acquire three samples from each boring, one surface and one floor sample will be collected from each sample core. The sample cores will be scanned for gamma radiation along the entire length of each core using a Ludlum Model 44-20 3-inch-by-3-inch NaI (or equivalent). Scan measurement results will be evaluated against the IL to identify core sections with elevated gamma radiation. Core sections that exceed the IL will have biased soil samples collected to investigate the potential for small areas of elevated activity in fill. If no core section exceeds the IL, a biased sample will be collected from the core segment with the highest gamma scan reading that was not already sampled, for a total of at least three samples from each core.

Additionally, systematic samples will be collected form sidewall locations every 50 linear feet, representative of each of the trench sidewalls. The boring locations will be located within 1 meter of the previous sidewall excavation limits and will extend to the maximum previous excavation depth. In the same action described in the previous paragraph, core sections will be retrieved, scanned, and sampled such that at least three samples will be collected from each of the six boring locations. Figure 8 provides an example graphic showing the sample locations representing the trench sidewalls.

If GPS reception is available, soil sample locations will be position-correlated with GPS data and recorded. If GPS reception is not available, a reference coordinate system will be established to document gamma scan measurement results and soil sample locations. The reference coordinate system will consist of a grid of intersecting lines referenced to a fixed site location or benchmark. If practical, the GPS coordinates of the fixed location or benchmark will be recorded.

Remediation of soil with analytical results above the RGs and background will be performed by excavation of the identified location of the elevated activity or by re-excavation of the complete trench (for Phase 2 trenches) for further processing using the RSY pad or soil sorting processes. Following re-excavation, a minimum of five bounding confirmation samples will be collected at the later and vertical extents to confirm the removal of contaminated soil. If a Phase 2 trench is re-excavated in its entirety, it will be investigated following the process described for a Phase 1 trench (Section 3.6.3). Material with potentially elevated activity will remain segregated until completion of the investigation activities.

3.7.4.1 Subsurface Soil Sample Collection

Subsurface soil samples will be collected using drilling-rig-mounted equipment to collect samples with thin-walled tube sampling or split-spoon sampling. When needed, other methods may be considered and applied. Specific sampling methods used will be documented in the field, and deviations from the WP will be described in the final report. Disposable sampling equipment will be used whenever practical and will be disposed of immediately after use. If reusable sampling equipment is used, decontamination between sampling locations will be performed. Generally, drilling and retrieving the boring using the thin-walled tube method will be as follows:

- Using a drilling rig, a hole is advanced to the desired depth. The samples are then collected following the ASTM International D 1587 standard.

- The sampler is lowered into the hole so that the sample tube's bottom rests on the bottom of the hole. The sampler is advanced by a continuous, relatively rapid downward motion. The sampler is withdrawn from the soil formation as carefully as possible to minimize disturbance of the sample. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch-internal-diameter sampler may be required.
- Upon removal of the tube from the ground, drill cuttings in the upper end of the tubs are removed, and the upper and lower ends of the tube are sealed. The soil tube will be turned over to the project geologist and radiation technician for sample preparation, radiological surveys, and containerization. Once retrieved from the hole, the tube is carefully cut open to maintain the material in the tube.

Generally, drilling and retrieving the boring using the split-spoon sampling method will be performed as follows:

- Using a drilling rig, a hole is advanced to the desired depth. The samples are then collected following the ASTM International D 1586 standard.
- The sampler is lowered into the hold and driven to a depth equal to the total length of the sampler; typically, this is 24 inches. The sampler is driven down using a weight ("hammer"). To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch-internal-diameter sampler may be required.
- Upon removal of the soil core from the ground, the soil core will be turned over to the project geologist and radiation technician for sample preparation, radiological surveys, and containerization. Once retrieved from the hole, the sampler is carefully split open to maintain the material in the tube.

Once the soil tube has been cut open or the core has been split open, soil examination and sample collection will occur as follows:

- The geologist will log the soil boring to provide accurate and consistent descriptions of soil characteristics. Soil boring logs will be maintained.
- The sample for radiological analyses will be mixed in the field by breaking the sample into small pieces and removing gravel. The depth, recovery position, and scan measurement information should be correlated to each sample extracted from the core.
- A minimum of 200 grams of soil (approximately 1 cup) is required to complete required analyses, or 400 grams if the sample is selected as a split sample. If sample size requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from below the original sample location within the core and compositing the sample.

- The entire mixed sample will be placed in the designated laboratory sample container and the range of soil depths included in the sample recorded in the field logbook.
- Samples will be identified, labeled, and cataloged according to the SAP (Appendix B) and Section 3.6.6, and then placed into the appropriate sample cooler (if required) for transport to the laboratory. Custody of the sample will be maintained.
- When a split sample is required (1 for every 10 field samples collected), the sample will be evenly split following mixing of the material and removal of extraneous material, and each aliquot placed into an appropriately labeled sample container.
- If insufficient soil for sampling is obtained from the original borehole, an adjacent location will be considered.

3.7.5 Sample Identification

Each soil sample will be uniquely identified at the time of collection, as described in the following subsections.

3.7.5.1 Phase 1 Trench Samples

Sample identifications from the Phase 1 trench investigation will be identified using the following format:

AABB-ESU-NNNA

Where:

AA = facility ("HP" for Hunters Point)

BB = site location ("D2" for Parcel D-2)

ESU = excavation soil unit

NNN = former trench number

A = alpha numeric digit of each "batch" (beginning with A, in sequential order)

Excavated material representing the sidewalls and bottoms of former trenches will use the following nomenclature format:

AABB-SFU-NNNA

Where:

AA = facility ("HP" for Hunters Point)

BB = site location ("D2" for Parcel D-2)

SFU = sidewall floor unit

NNN = former trench number

A = alpha numeric digit of each "batch" (beginning with A, in sequential order)

3.7.5.2 Phase 2 Trench Samples

Sample identifications from the Phase 2 soil trench investigation will be identified using the following format:

AABB-CCC-SB-Depth

HPD2-TU#-SB#-Depth

Where:

AA = facility ("HP" for Hunters Point)

BB = site location ("D2" for Parcel D-2)

CCC = ESU TU#

SB = soil boring number

Depth = two-digit sample interval in feet below ground surface

3.7.6 Soil Investigation Near Fischer and Spear Avenues

This area investigation addresses a former worker's allegation that the worker collected a soil sample from behind the retaining wall northwest of intersection between Fischer Avenue and Spear Avenue. It was alleged that both the sample and the record of its analysis were discarded. Soil behind the retaining wall is composed of 2 feet of imported fill soil, underlain by native fill. To address the potential former soil sample with elevated ^{137}Cs, the investigation area will be initially gamma scanned for gamma radiation using a 3-inch-by-3-inch NaI detector. Gamma scan survey measurements will be compared against the instrument-specific ILs developed in accordance with Section 3.3.1 of this WP. Seven characterization sample locations will be selected approximately 10 feet apart near the intersection of Fischer Avenue and Spear Avenue. GPS coordinates will be obtained at each sample location. Additional biased samples may be obtained following the evaluation of the surface gamma scan survey logged data. The SAP (Appendix B, Figure 10) identifies the investigation and characterization sample locations. A hand auger or similar device will be used to collect the soil samples from the surface to the native fill. Soil samples will be scanned for gamma radiation using a 3-inch-by-3-inch NaI.

A registered Professional Geologist or Professional Civil Engineer, licensed in California, will supervise or perform the sample collection, and boring logging. Soil will be logged in accordance with the Unified Soil Classification System, and boring logs will illustrate the soil boring lithology, gamma readings, and soil sample locations.

Each sample location will have one sample collected from the top 6 inches of soil, and a second sample from the top of the native fill. Native fill is expected to be between 1 to 2 feet below the existing ground surface and will be verified in the field by the competent person overseeing this work. After samples are collected, the boring locations will be backfilled with soil cuttings, and the surface will be restored to match existing conditions. Results of the radiological investigation for this location will be documented in a RACR.

3.7.7 Site Restoration and Demobilization

The open excavations will be backfilled with the excavated soil upon concurrence from RASO. The excavated material will be returned to the same trench that the material originated from. If additional backfill is required, a clean import source will be identified and used. Imported fill will be sampled and analyzed (SAP [Appendix B]) and will be approved by RASO before use. If the trench excavations are water logged, crushed rock or gravel will be placed as bridging material. With Navy concurrence, radiologically cleared recycled fill materials (e.g., crushed asphalt and/or gravel underlayment) may be used for backfill. The backfill will be compacted to 90 percent relative density by test method ASTM International D 1557. Once the excavated areas have been backfilled, the durable cover will be repaired “in kind” to match pre-excavation action conditions.

3.7.7.1 Deconstruction of Radiological Screening Yard Pads

Following completion of radiological screening and with Navy approval, the RSY pads will be deconstructed. Before deconstruction, the RSY pads will be radiologically screened and released (Section 3.7.3.2). The area will be downposted for the deconstruction activities. The RSY pad material will be consolidated on site for on-site reuse or off-site disposal at an approved disposal facility. Following deconstruction, the area will be restored to pre-removal action conditions.

3.7.7.2 Decontamination and Release of Equipment and Tools

Decontamination of materials and equipment will be conducted as required during and between each separate excavation task, and at the completion of fieldwork. Decontamination follows the performance of alpha/beta contamination surveys and gamma scan/static measurements. Numerous decontamination methods are available for use. If practical, manual decontamination methods should be used. Abrasive methods may be necessary if areas of fixed contamination are identified. Chemical decontamination can also be accomplished by using detergents for nonporous surfaces with contamination present. Chemicals should be selected for decontamination that will minimize the creation of mixed waste.

Visible dirt or debris will be removed from equipment with a brush and/or a masselin wipe. The equipment and wipe will be measured to confirm the absence of activity above applicable control levels (AMS-710-07-WI-40111, “Performing and Documenting Radiation and Contamination Surveys” [APTIM, 2020]) and using the surface contamination criteria from Radiation Safety Surveys at Medical Institutions, Regulatory Guide 8.23 (NRC, 1981). In RCAs, equipment decontamination and release will be in accordance with the RPP (APTIM, 2019b), and project specific work instructions. Detectable levels of activity during decontamination will trigger notification to the Navy for further direction.

For larger pieces of equipment, equipment decontamination areas will be constructed by placing an impermeable surface (e.g., plastic sheeting) to catch material removed from equipment. At a minimum, equipment will be decontaminated by dry brushing.

3.7.8 Demobilization

Demobilization will consist of surveying, decontaminating, and removing equipment and materials, cleaning the project site, inspecting the site, and removing temporary facilities. Survey of equipment and materials and decontamination will be performed (Section 3.7.7.2). Demobilization activities will also involve collection and disposal of contaminated materials, including decontamination water and disposable equipment for which decontamination is inappropriate (Section 7.0).

3.8 Radiological Laboratory Analysis

Samples will be containerized and submitted to an off-site laboratory with appropriate chain-of-custody documentation (SAP [Appendix B]). Laboratory analyses will be performed by a U.S. Department of Defense Environmental Laboratory Accreditation Program- or National Voluntary Laboratory Accreditation Program-accredited laboratory certified by the State of California to perform analyses. Soil samples will be retained for possible California Department of Public Health confirmatory analysis until a final RACR for Parcels D-2, UC-1, UC-2, and UC-3 is issued.

Analysis will be based on the site-specific ROCs (SAP [Appendix B]) and as follows:

- Soil samples will be assayed using gamma spectroscopy analysis for ^{137}Cs and ^{226}Ra. Gamma spectroscopy data will be reported for gamma-emitting ROCs by the laboratory after a full 21-day ingrowth period.
    - If the gamma spectroscopy laboratory results indicate a concentration of ^{226}Ra above the RG plus background in a sample, the sample will be analyzed using alpha spectroscopy for ^{238}U, ^{234}U, ^{230}Th, and ^{226}Ra to evaluate equilibrium conditions. Section 5.6 provides additional details regarding the equilibrium evaluation. Detected isotopes will be reported.
    - If laboratory results indicate a concentration of ^{137}Cs above the RG or background, whichever is higher, in a sample, the sample will be analyzed by gas flow proportional counting for ^{90}Sr.
- At least 10 percent of randomly selected samples will be analyzed by gas flow proportional counting for ^{90}Sr.

If the results following the full ingrowth are below the RGs (Table 5), then additional analyses are not required.

Laboratory data packages will have independent data verification and data validation performed to demonstrate that the data meet the project objectives. Following independent data verification and validation, the sample data will be evaluated (Section 5.0).

4.0 BUILDING INVESTIGATION DESIGN AND IMPLEMENTATION

This section describes the DQOs, ROCs, RGs, ILs, and radiological investigation design and implementation for Buildings 813 and 819.

4.1 Data Quality Objectives

The following subsections detail the building investigation DQOs.

4.1.1.1 Step One—State the Problem

Evidence was found of potential contractor data manipulation and falsification. The findings call into question the reliability of the data and uncertainty as to whether radiological contamination was present or remains in place. Therefore, the property is unable to be transferred as planned. Based on the uncertainty and the description of radiological activities in the HRA (NAVSEA, 2004), there is a potential for residual radioactivity to be present on building interior surfaces.

4.1.1.2 Step Two—Identify the Objective

The primary objective is to determine whether site conditions are compliant with their respective RAOs (Navy, 2009a, 2010).

4.1.1.3 Step Three—Identify Inputs to the Objective

The inputs include alpha-beta static, alpha-beta scan, and alpha-beta swipe data on building and reference area surfaces.

4.1.1.4 Step Four—Define the Study Boundaries

The study boundaries are accessible interior surfaces of Buildings 813 and 819 (Figures 10 and 11).

4.1.1.5 Step Five—Develop Decision Rules

If the investigation results demonstrate that there are no exceedances determined from a point-by-point comparison with the RGs at agreed upon statistical confidence levels, or that residual ROC concentrations are NORM or anthropogenic background, then a RACR will be developed.

If the investigation results demonstrate exceedances of the RGs determined from a point-by-point comparison with the statistically-based RGs at agreed upon statistical confidence levels and are not shown to be NORM or anthropogenic background, then remediation will be conducted, followed by a RACR.

The RACR will describe the results of the investigation, explain remediation performed, compare the distribution of data from the sites with applicable reference area data, and provide a demonstration that site conditions are compliant with the respective RAOs through the use of multiple lines of evidence including application of statistical testing with agreed upon statistical confidence levels on the background data.

4.1.1.6 Step Six—Specify the Performance Criteria

Section 5.0 presents the following data evaluation process for demonstrating compliance with the respective RAOs:

- Compare each net alpha and net beta static and smear result to the corresponding RG (Section 4.3). If results are less than or equal to the RGs, then compliance with the respective RAOs is achieved.
- Compare sample data to appropriate RBA data from HPNS (Section 5.0). Multiple lines of evidence will be evaluated to determine whether site conditions are consistent with NORM or anthropogenic background. The data evaluation may include, but is not limited to, population-to-population comparisons, use of a maximum likelihood estimate or background threshold value, and graphical comparisons. If survey data are consistent with NORM or anthropogenic background, then site conditions comply with the respective RAOs.
- If a result is greater than the RG and cannot be attributed to NORM or anthropogenic background, then remediation will be conducted.

4.1.1.7 Step Seven—Develop the Plan for Obtaining Data

Radiological investigations will be conducted on floors and wall surfaces, and will consist of alpha and beta scan surveys, alpha-beta static measurements, and alpha-beta swipe samples, as described in the following subsections.

4.2 Radionuclides of Concern

Although the only ROC listed in the HRA (NAVSEA, 2004) for Building 813 is ^{90}Sr, ^{137}Cs and ^{226}Ra are considered additional ROCs for Building 813 based on observations during the previous building survey. The ROCs listed in the HRA for Building 819 is ^{137}Cs and ^{226}Ra. Table 7 lists the ROCs for Building 813 and 819.

4.3 Remediation Goals

The building data from the radiological investigations will be evaluated to determine whether site conditions are compliant with the respective RAOs (Navy, 2019a, 2010). The RAOs are to prevent exposure to ROCs in concentrations that exceed RGs for potentially complete exposure pathways. Table 5 presents RGs for structures, equipment, and waste for each of the ROCs identified for the applicable buildings.

Data collected from building surfaces during this investigation represent the total (fixed and removable) gross activity on the surface, which may result from radiations from multiple radionuclides. Because these survey data are radiation-specific (alpha and beta) but not radionuclide-specific, they cannot be attributed to a particular ROC. Instead the survey data will be compared to the most restrictive building-specific RG (Table 7).

4.4 Radiological Investigation Design

This subsection describes the design of radiological investigations, including scan and static measurements on building surfaces. The radiological investigation design is based on methods, techniques, and instrument systems in the *Basewide Radiological Management Plan, Hunters Point Shipyard, San Francisco, California* (TtEC, 2012a), with the ultimate requirement to demonstrate compliance with the respective RAOs.

The principal features of the investigation protocol to be applied to Buildings 813 and 819 are discussed herein and include the following:

- Determine the SUs
- Select survey instruments
- Determine instrument ILs and MDCs

To the extent possible, manual data entries will be eliminated through use of electronic data collection and transfer processes.

4.4.1 Building Survey Overview

The radiological surveys of the impacted Buildings 813 and 819 have two primary components: scanning measurements (Sections 4.4.1.1) and static measurements (Section 4.4.1.2). In addition, swipe samples will be collected to assess potential gross alpha and beta removable contamination. If needed, swipe samples will be analyzed off site to speciate the radionuclides present. Building material samples may be collected and analyzed off site to characterize areas of interest identified by the surveys.

4.4.1.1 Scanning Measurements

Scanning measurements are performed on building surfaces to locate radiation anomalies indicating residual radioactivity that may require further investigation or remediation. As noted in Section 4.3, the scanning design is dictated by the most restrictive RG per radiation type for the building. Where appropriate, scanning measurements will be performed using the assumptions of equilibrium (Section 4.5.5).

4.4.1.2 Static Measurements

Static measurements will be the primary means of demonstrating compliance with the respective RAOs. The length of the gross alpha and beta static measurements will be sufficient so that the measurement MDC is below the RGs for the building.

Static measurements will be performed in each SU and in the RBAs. They will consist of measurements in scaler mode for simultaneous alpha-beta counting using a Ludlum Model 43-37, Ludlum Model 43-93 plastic scintillation detector, or other appropriate instrument. While one-minute count times were used in the following example calculations, static count times will be updated during investigations to meet DQOs using instrument-specific information. Static measurements will be performed on a systematic sampling grid and biased to locations identified by the alpha-beta scanning surveys.

The number of systematic static measurements performed will be based on MARSSIM Sections 5.5.2.2 and 5.5.2.5 (EPA et al., 2000) using the unity rule as the example basis for calculating the minimum static measurement frequency. Even if the MARSSIM-recommended or other statistical tests are not used to evaluate site data, these calculations serve as a basis for determining the number of static measurements per SU to be performed. The number of biased static measurements will be determined based on the results of scan surveys.

MARSSIM Section 5.5.2.2 (EPA et al., 2000) defines the method for calculating the number of static measurements when residual radioactivity is uniformly present throughout a SU. Therefore, determining the number of static measurements will be based on the following factors:

- RG for radioactivity on structural surfaces (UBGR)
- LBGR
- Estimate of variability (standard deviation [σ]) in the reference area and SUs
- Shift (Δ = UBGR-LBGR)
- Relative shift ([UBGR/LBGR]/σ) (Equation 4-1)
- Decision error rates for making a Type I or Type II decision error that the mean or median concentration exceeds the RG (MARSSIM Table 5.2)

Each of the preceding factors is addressed in the following paragraphs. Example data are provided to assist in explaining the process for calculating the minimum static measurement frequency. Actual numbers of static measurements for SUs will be based on reference area data once they become available. When using the unity rule, the RG is defined as 1 (unitless) plus background. As a basis for the calculations, the background surface activity concentration is assumed to be 0.5.

MARSSIM (EPA et al., 2000) defines a gray region as the range of values in which the consequences of decision error on whether the residual surface activity is less than or exceeds the RG are relatively minor. The RG of 1 above background (0.5) was selected to represent the UBGR (1.5). The LBGR is the median concentration in the SU, and the retrospective power will be determined after the survey is completed. Given the absence of usable data prior to performing the investigation activities, MARSSIM Section 2.5.4 suggests arbitrarily selecting the LBGR as half the RG. Therefore, for this example, the LBGR = 0.5 + 0.5 = 1. Assuming the UBGR equals the RG, then Δ = 1.5 – 1.0 = 0.5 for this example.

MARSSIM (EPA et al., 2000) defines σ as an estimate of the standard deviation of the measured values in the SU. Because SU data will not be available until the investigation activities are completed, MARSSIM recommends using the standard deviation of the RBA as an estimate of σ. Given the absence of data prior to performing the investigation activities, an arbitrary value of 0.25 has been selected as an estimate of σ for this example.

The relative shift is calculated based on MARSSIM Section 5.5.2.2 (EPA et al., 2000):

Equation 4-1

$$\frac{\Delta}{\sigma} = \frac{(UBGR - LBGR)}{\sigma} = \frac{(RG - LBGR)}{\sigma} = \frac{(1.5 - 1.0)}{0.25} = 2.0$$

The minimum number of samples assumes the ROC concentration in the SU exceeds the RG. Type I decision error is deciding that the ROC concentration in the SU is less than the RG when it actually exceeds the RG. To minimize the potential for releasing buildings with concentrations above the RG, the Type I decision error rate is set at 0.01. Type II decision error is deciding that the ROC concentration exceeds the RG when it is actually less than the RG. To protect against remediating building surfaces with concentrations below the RG, the Type II decision error rate is set at 0.05 as recommended by MARSSIM (EPA et al., 2000).

MARSSIM Table 5.3 (EPA et al., 2000) lists the minimum number of static measurements to be performed in each SU and RBA based on the relative shift and decision error rates. For a relative shift of 2, a Type I decision error rate at 0.01, and Type II decision error rate of 0.05, MARSSIM Table 5.3 recommends a minimum of 18 static measurements in each SU and RBA.

Therefore, 18 static measurements are recommended as a placeholder until background data are available. The minimum number of static measurements per SU will be developed based on the variability observed in the RBA data. The DQA of SU data will include a retrospective power curve (based on MARSSIM Appendix I [EPA et al., 2000]) to demonstrate that enough static measurements were performed to meet the project objectives. If necessary, additional static measurements may be performed to comply with the project objectives.

4.4.2 Radiological Background

Building 404 will serve as the primary RBA in the investigation of Buildings 813 and 819. Building 404 is a non-impacted, unoccupied former supply storehouse constructed in 1943. From the same construction era and with materials similar to those of the impacted buildings, Building 404 has 43,695 square feet of concrete floors, a wooden superstructures, prepared roll or composition roof, and drywall offices.

At least 18 static measurements will be taken on each surface material in the RBA that is representative of the material in Buildings 813 and 819. Alternate RBAs may be identified and used if needed based on site-specific conditions identified during the building investigations.

4.4.3 Survey Units

Buildings 813 and 819 will be divided into identifiable SUs similar in area and nomenclature to the previous investigations. Building 813 was previously divided into 24 SUs and Building 819 was divided into 4 SUs. Generally, impacted floor surfaces and the lower 2 meters of remaining impacted wall surfaces will form Class 1 SUs of no more than 100 m^2 each.

This investigation measures accessible and impacted surfaces through a combination of radiological scanning, static, and swipe measurements. The SU designations and floor boundaries will remain the same as those used in the historical TtEC investigations.

Figures 10 and 11 show the floor plans and floor SUs for each building. The following subsections provide additional building-specific information regarding Buildings 813 and 819.

4.4.3.1 Building 813

The first floor of Building 813 was divided into 18 Class 1 SUs, 2 Class 2 SUs, and 1 Class 3 SU. Class 1 SUs consists of floor and lower wall areas less than 100 m^2, while Class 2 SUs had floor areas less than 1,000 m^2. The Class 3 SU encompassed the remaining portions of the first floor. Upper walls above 2 meters and the ceilings were not included.

4.4.3.2 Building 819

Building 819 consists of four Class 1 SUs, consisting of floors and walls less than or equal to 2 meters above the respective floor areas. Each SU is less than 100 m^2 in area. The SUs are the Wet Well (SU 1), the Dry Well (SU 2), the inlet culvert (SU 3), and the bypass culvert (SU 4), as shown on Figure 11.

4.4.4 Reference Coordinate System

SU scan grids and static measurement locations will be marked using a consistent reference coordinate system throughout the building. In the absence of other technologies, locations will reference from the southernmost and westernmost point in the SU.

4.5 Instrumentation

Investigation data will be collected using gas proportional counters, plastic scintillation detectors, and swipe sample counters, as described in the following subsections.

4.5.1 Gas Proportional Detectors

Large area surface scanning and static measurements for alpha and beta radiations will be performed using gas proportional detectors (such as the large area Ludlum Model 43-37). Ludlum Model 43-93 scintillation detector, or equivalent instruments) will be used for scanning measurements in areas that are not accessible to or practicable for larger instruments. The Ludlum Model 43-37 detector physical size is 2.5 cm by 15.9 cm by 46.4 cm (height by width by length), with an active area of 584 cm^2. Scanning speed is surveyor-controlled, and data are automatically logged when used with an appropriate data-logging scaler/ratemeter (such as the Ludlum Model 2360 or equivalent).

4.5.2 Scintillation Detectors

Alpha-beta scintillation detectors may also be used for scanning and static measurements. The Ludlum Model 43-93 has an active detector area of 100 cm^2 and simultaneously counts alpha radiation using a zinc sulfide scintillator and beta radiation using a thin plastic scintillator.

4.5.3 Alpha-Beta Sample Counter

Swipe samples to assess removable activity will be counted using an alpha-beta plastic scintillation counter (such as the Ludlum Model 3030 Alpha-Beta Sample Counter or equivalent). The Ludlum Model 3030 has an active detector area of 20.3 cm^2 and simultaneously counts alpha-beta radiation from 5.1-cm swipe papers loaded into a single sample tray.

4.5.4 Calibration

Portable survey instruments will be calibrated annually at a minimum, in accordance with *Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments*, N3232a-1997 (American National Standards Institute, 1997), or an applicable later version. Instruments will be removed from service on or before calibration due dates for recalibration. If the *Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments*, N3232a-1997 does not provide a standard method, the calibration facility should comply with the manufacturer’s recommended method.

4.5.5 Daily Performance Checks

Before each day’s use, the portable survey instruments, calibration verification, physical inspection, battery check, and source-response check will be performed in accordance with AMS-710-07-WI-04014, “Radiation Detection Instruments” (APTIM, 2020b). Portable survey instruments will have a current calibration label that will be verified daily before use.

Physical inspection of the portable survey instrument will include the following:

- General physical condition of the instrument and detector before each use including
    - Knobs, buttons, cables, connectors
    - Meter movements and displays

- Instrument cases
- Probe and probe windows
- Other physical properties that may affect the proper operation of the instrument or detector

Portable survey instruments or detectors with questionable physical conditions will not be used until problems have been corrected. A battery check will be performed to ensure that sufficient voltage is being supplied to the detector and instrument circuitry for proper operation. This check will be performed in accordance with the instrument's operations manual. The instrument will be exposed to the appropriate (alpha and/or beta) check source, to verify that the instrument response is within the plus or minus 3 sigma range determined during the initial response check. The calibration certificates and daily QA/QC records for each instrument used and the instrument setup test records will be provided in the project report.

If portable instruments, or instrument and detector combinations, with questionable physical condition that cannot be corrected fails the operation checks or exceeds its annual calibration date without PRSO approval, the instrument will be put in an "out of service" condition. This is done by placing an "out of service" tag or equivalent on the instrument or instrument and detector combination. The instrument cannot be issued for use. The PRSO and radiological control technicians and their respective supervisors will be notified immediately when survey instrumentation has been placed "out of service." Instruments tagged as "out of service" will not be returned to service until deficiencies have been corrected. The results of the daily operation checks, discussed above, will be documented.

4.5.6 Alpha Detection Probability and Scan Speed

Scanning for alpha emitters differs significantly from scanning for beta and gamma emitters in that the expected background response of most alpha detectors is very close to zero.

4.5.6.1 Ludlum Model 43-93

Due to the low (near zero) background count rates when using small area detectors, it is not practical to determine a fixed MDC for scanning. Instead the probability of detecting an area of contamination at a predetermined release level for a given scan rate is calculated.

The probability of detecting given levels of alpha surface contamination for smaller detectors can be calculated by use of Poisson summation statistics. Given a known measurement interval and a surface contamination release limit, the probability of detecting a single count for the measurement interval to be used during this project and using typical instrument and background data is given by Equation 4-2. A probability of detection should be as close as practicable to 90 percent, but will not be lower than 68 percent.

Equation 4-2

$$P(n \geq 1) = 1 - e^{\frac{-(G\varepsilon_s \varepsilon_i + B)t}{60}}$$

Where:

$P(n \geq 1)$ = probability of observing a single count

G = surface contamination release limit (100 disintegration per minute [dpm]/100cm^2)

ε_i = detector efficiency (2π)

ε_s = surface efficiency (0.25)

B = Background count rate

t = measurement interval

Using a typical detector efficiency of 0.384, a background count rate of 2 cpm, and a measurement interval of 14 seconds (corresponding to a scan speed of 0.5 cm per second [cm/s]), the probability of detection is approximately 93 percent. The probability of detection will be re-calculated in the field prior to the start of work using actual detector efficiencies and backgrounds.

The predicted scan speed is something that cannot be practically implemented in the field. Therefore, a series of short static counts may be performed to simulate scanning data for this project. Using the calculation for alpha static MDC in Section 4.5.8, performing statics that are one minute long will achieve an MDC below the alpha RG.

4.5.6.2 Ludlum Model 43-47

Larger gas proportional detectors have alpha background count rates on the order of 1 cpm to 10 cpm. If the background counts is less than or equal to 5 cpm, a single count will not cause a surveyor to investigate further. A counting period long enough to establish that a single count indicates an elevated contamination level would be prohibitively inefficient. For an instrument with lower background, the surveyor usually will need to get at least two counts while passing over the source are before stopping for further investigation. Assuming this assumption is valid, the probability of getting two or more counts can be calculated by Equation 4-3.

Equation 4-3

$$P(n \geq 2) = 1 - \left[1 + \frac{(G\varepsilon_i\varepsilon_s + B)t}{60}\right]\left[e^{\frac{-(G\varepsilon_i\varepsilon_s+B)t}{60}}\right]$$

Where:

$P(n \geq 2)$ = probability of getting two or more counts during the time interval t

t = time interval of detector over source (seconds)

G = surface contamination release limit (dpm)

ε_i = detector efficiency (2π)

ε_s = surface efficiency (0.25)

B = background count rate (cpm)

The time interval t_{scan} is determined by dividing the width of the detector (13.3 cm) by the scan speed (1 cm/s), resulting in a t_{scan} of 13.3 seconds. Using typical background (5 cpm) and detector efficiency values (0.4108), an estimated alpha detection probability is 85.1 percent for a 100 dpm/100 cm^2 hot spot. Detection probabilities will be determined in the field prior to start of work using actual detector efficiencies and background values.

4.5.7 Beta Scanning

For scanning building surfaces, the beta scan MDC should be determined using Equation 4-4. The index of sensitivity is selected to be 1.38, which is for 95 percent detection of a concentration equal to the scan MDC with a 60 percent false positive rate. MDCs will be re-calculated prior to the start of work using actual detector efficiencies and background values.

Equation 4-4

$$MDC_{scan}(surfaces) = \frac{1.38\sqrt{C_{bscan}}}{(\sqrt{p})(\varepsilon)(t_{scan})\left(\frac{A}{100cm^2}\right)}$$

Where:

1.38 = index of sensitivity d'

C_{bscan} = Average background counts in time interval t_{scan}

p = Surveyor efficiency (0.5)

ε = Instrument 2 pi total efficiency

t_{scan} = time interval while the probe passes over the source, in minutes

A = Active area of the probe in cm^2

4.5.7.1 Ludlum Model 43-93

For beta scanning with the Ludlum Model 43-93, assuming a scan speed of 0.5 cm/s as determined above, and using typical background and detector efficiency values, the scan MDC is approximately:

$$\frac{1.38\sqrt{(140\ cpm)(\frac{1min}{60\ s})(14\ s)}}{(\sqrt{0.5})(0.4)(0.5)(14\ s)(\frac{1min}{60\ s})(\frac{100\ cm^2}{100\ cm^2})} \cong 239\ dpm/100cm^2$$

4.5.7.2 Ludlum Model 43-37

For beta scanning with the Ludlum Model 43-37, assuming a scan speed of 1.0 cm/s as determined above, and using typical background and detector efficiency values, the scan MDC is approximately:

$$\frac{1.38\sqrt{(400\ cpm)(\frac{1min}{60\ s})(13.3\ s)}}{(\sqrt{0.5})(0.5)(0.5)(13.3\ s)(\frac{1min}{60\ s})(\frac{584\ cm^2}{100\ cm^2})} \cong 56.8\ dpm/100cm^2$$

4.5.8 Static Minimum Detectable Concentration

The static MDC represents the smallest level of radioactivity on a surface that is statistically detectable by the measurement process. The conventional equation based on MARSSIM Equation 6-7 (EPA et al., 2000) is used to calculate instrument MDC in units of dpm/100cm^2:

Equation 4-5

$$MDC = \frac{3 + 4.65\sqrt{R_B T_B}}{\varepsilon_s \varepsilon_i \frac{W_A}{100} T_B}$$

Where:

R_B = background count rate (cpm)

T_B = background counting time (minutes)

ε_i = instrument efficiency

ε_s = surface efficiency (0.25 for alpha)

W_A = active area of the detector window (cm^2)

Ludlum Model 43-93

Using typical background and efficiency values for a Ludlum Model 43-93, with a two-minute static count time, the alpha static MDC is:

$$MDC = \frac{3 + 4.65\sqrt{(2)(2)}}{(0.384)(0.25)\left(\frac{100}{100}\right)(2)} \cong 64\ dpm/100cm^2$$

The beta static MDC for a Ludlum Model 43-93 is:

$$MDC = \frac{3 + 4.65\sqrt{(140)(2)}}{(0.40)(0.5)\left(\frac{100}{100}\right)(2)} \cong 202\ dpm/100cm^2$$

Therefore, static measurements performed with the Ludlum Model 43-93 will meet the RGs, as listed in Table 5. Actual MDCs will be re-calculated prior to the start of work using actual detector efficiencies and background values.

Ludlum Model 43-37

Using typical background and efficiency values for a Ludlum Model 43-37, with a one minute static count time, the alpha static MDC is:

$$MDC = \frac{3 + 4.65\sqrt{(1.3)(1)}}{(.4108)(0.25)(\frac{584}{100})(1)} \cong 14\ dpm/100cm^2$$

The beta static MDC for a Ludlum Model 43-37 is:

$$MDC = \frac{3 + 4.65\sqrt{(400)(1)}}{(.528)(0.5)(\frac{584}{100})(1)} \cong 63\ dpm/100cm^2$$

Therefore, static measurements performed with the Ludlum Model 43-37 will meet the RG for alpha emitters, as listed in Table 5. Actual MDCs will be re-calculated prior to the start of work using actual detector efficiencies and background values.

4.5.9 Alpha and Beta Investigation Levels

ILs for the alpha and beta surveys will be equal to the action levels for the more restrictive ROC in each area to be surveyed, as listed in Table 5. If SU measurements suggest that the selected reference area for the SU may not be appropriate, additional data will be collected to characterize and document the radiological conditions of the SU. If data suggest that anomalous measurements are the result of possible contamination, additional characterization and remediation requirements to meet project objectives will be addressed on a case-by-case basis with input from the Navy.

4.6 Radiological Investigation Implementation

Investigations will be generally implemented in the following order of activities: premobilization/mobilization, surveys, additional investigations, and demobilization.

4.6.1 Premobilization Activities

Before the start of survey activities, a walkthrough of Buildings 813 and 819 will be completed to accomplish the following:

- Establish building access points and assess security requirements
- Assess survey support needs (such as power, lighting, ladders, or scaffolding)
- Verify the types of materials in each SU
- Identify safety concerns and inaccessible or difficult-to-survey areas
- Identify radiological protection and control requirements
- Identify materials requiring removal or disposal (such as water), and areas requiring cleaning
- Assess methods for marking survey scan lanes and static measurement locations

Impacted areas that are deemed unsafe for access or surveys will be posted, secured, and annotated in reports.

4.6.1.1 Training Requirements

Required non-site-specific training required for field personnel will be performed before mobilization to the extent practical. Section 6.0 outlines training requirements.

Medical examinations, medical monitoring, and training will be conducted in accordance with the APP/SSHP (APTIM, 2019a). In addition to health and safety-related training, other training may be required as necessary including but not limited to the following:

- Aerial lift (for personnel working from aerial lifts)
- Fall protection (for personnel working at heights greater than 5 feet)
- Equipment as required (e.g., forklift, skid steer, loader, back hoe, excavator)

4.6.1.2 Permitting and Notification

Before initiation of field activities for the radiological investigations, the contractor will notify the Navy RPM, ROICC, and RASO and HPNS security as to the nature of the anticipated work. Required permits to conduct the fieldwork will be obtained before mobilization.

The contractor will notify the California Department of Public Health at least 14 days before initiation of activities involving the Radioactive Materials License.

4.6.1.3 Pre-Construction Meeting

A pre-construction meeting will be held before mobilization of equipment and personnel. The purpose of the meeting will be to discuss project-specific topics, roles and responsibilities of project personnel, project schedule, health and safety concerns, and other topics that require discussions before field mobilization. Representatives of the following will attend the pre-construction meeting

- Navy (RPM, RASO, ROICC, and others as applicable)
- Contractor (Project Manager, Site Construction Manager, Project QC Manager, PRSO, and SSHO)
- Subcontractors as appropriate

4.6.2 Mobilization Activities

Mobilization activities will include site preparation, movement of equipment and materials to the site, and orientation and training of field personnel.

At least two weeks before mobilization, the appropriate Navy personnel, including the Navy RPM, ROICC, and Caretaker Site Office, will be notified regarding the planned schedule for mobilization and site remediation activities. Upon receipt of the appropriate records and authorizations, field personnel, temporary facilities, and required construction materials will be mobilized to the site.

The temporary facilities will include restrooms, hand-washing stations, and one or more secure storage (Conex) boxes for short- and long-term storage of materials, if needed.

The applicable AHAs will be reviewed prior to starting work.

Equipment mobilized to the site will undergo baseline radioactivity surveys (Section 6.0). Surveys will include direct scans, static measurements, and wipe samples. Equipment that fails baseline surveying will be removed from site immediately.

Loose, residual debris present in the buildings that may interfere with the performance of planned surveys will be assessed by radiological survey and removed for disposal and to prepare the buildings for cleaning. Cleaning will be sufficient to remove loose, surface material that may not be native to the building construction and may inhibit or damage survey instruments. Cleaning activities will be conducted consistent with the radiation protection procedures (Section 6.4). Dust control methods and air monitoring will be implemented, if warranted (Section 8.5). Floors will be cleaned using ride-on floor scrubbers and vacuums. Walls and other surfaces will be cleaned as required during surveying. Wet areas will be dried using vacuums, blowers, or squeegees and may be delineated with spill containment booms if water infiltration is recurrent. Waste from debris removal and cleaning activities will be evaluated (Sections 6.4 and 7.0).

4.6.3 Building Investigation and Remediation Activities

Once site preparation activities previously described are completed, building investigation and remediation activities will commence in the following general sequence:

- Mark SUs
- Prepare instruments
- Perform alpha-beta scanning in SUs and RBA and conduct preliminary data review
- Perform alpha-beta systematic static and swipe measurements in SUs and RBA and conduct preliminary data review
- Perform alpha-beta biased static and swipe measurements in SUs and conduct preliminary data review
- Delineate and remediate residual contamination, if present
- Evaluate and report data (Section 5.0)

4.6.3.1 Survey Unit Preparation

SUs will be durably marked prior to measurement activities to indicate SU boundaries, number, scan lanes and directions, and systematic measurement locations. A grid system will be employed to assist in tracking and documenting surveys. Typically, grids will be laid out from a designated origin (such as the southwest corner of the room) and will have uniform grid increments (such as 1 m^2). The survey grid and numbering system will be established on floors and lower walls as required. Upon receipt of survey instruments for the building investigations and completion of performance checks, background measurements will be obtained in the RBAs for each instrument and on each surface material type (e.g., concrete, metal, wood, sheet rock) that is also present in the SUs. The background measurements will consist of at least 18 static measurements on each surface to match the number performed in each SU. The mean instrument- and material-specific background count rate will be used to update the instrument detection calculations and static count times (Section 4.5.8).

4.6.3.2 Survey Unit and Reference Background Area Alpha-beta Scanning

SUs will be scanned to detect alpha and beta emitters using average scan rates that ensure an alpha probability of detection of approximately 90 percent where feasible and that the beta scan MDC is less than or equal to the RG_β for the building. Scanning will cover a total area of each SU according to its classification. The total surface area of remaining, accessible impacted surfaces to be scanned will be 100 percent in Class 1 SUs, 50 percent in Class 2 SUs, and up to 10 percent in Class 3 SUs.

The distance scanned is the linear distance, in cm, traveled by the detector during data acquisition. The scan duration is the total time, in seconds, of data acquisition. Dividing the distance scanned by the scan duration gives an estimate of the average detector scan rate (cm/s) for that scanning period. The scan rates for non-motorized instruments (e.g., Ludlum Model 43-37, Ludlum Model 43-68) are manually controlled by the surveyor and will be verified manually in each SU by direct observation and measurement of the time elapsed while scanning a known distance.

Areas inaccessible to a large area monitor will be scanned using a gas proportional detector or plastic scintillator detector with data-logging functions. A DQA of the alpha-beta scan data will identify locations that exceed the applicable beta scan IL and, therefore, require further investigation. Alpha-beta scan data will also be used to verify the assumptions for the relative shift and revise the number of static measurements for each SU, if necessary.

4.6.3.3 Survey Unit Systematic Alpha-Beta Static Measurements

Static measurements will be performed at each systematic static location and will total 18 in each SU and the RBA, or the revised number (Section 4.4.1). Locations that pose safety concerns or obstructions will be relocated to the nearest accessible location and noted on the field measurement forms.

Each static measurement will be performed in scaler mode for a count duration sufficient to ensure that the alpha and beta static MDCs are equal to or less than the RGs for the building. A DQA of the static measurement data will identify locations that exceed the applicable alpha or beta static IL and, therefore, require further investigation or remediation.

4.6.3.4 Biased Alpha-Beta Static Measurements

Biased static measurements will be used to further investigate areas with potential elevated surface activity, as indicated by alpha or beta scan data exceeding the applicable alpha or beta scan IL or systematic static data exceeding the applicable alpha or beta static IL. The survey meter will be operated in scaler mode and measurements will be made for the same count duration as that for the systematic static measurements.

4.6.3.5 Alpha-Beta Swipe Samples

Swipe samples will be taken at locations of systematic and biased static measurements. They will be taken dry, using moderate pressure, over an area of approximately 100 cm^2. Swipe samples will be measured for gross alpha and beta activity using a Ludlum Model 3030 or equivalent. In addition to comparison with the RGs for removable contamination (Table 5), the surface activity on the sample will be compared to the total surface activity measured by the static measurement to assess the removable fraction of surface activity. This information will be used in dose or risk assessments performed.

4.6.3.6 Assessment of Residual Materials and Equipment

Several buildings contain residual materials and equipment from past operations (such as piping, ventilation, shelving, or machinery) that will undergo radioactivity surveys. These surveys may include a combination of surface scans and static measurements, swipe samples, and material samples. Where possible, sampling or survey points accessed during previous surveys will be used as a starting point. Surveys of impacted building material and equipment will be incorporated into the building SU. After data evaluation, disposition decisions, and subsequent investigation of the surfaces below the materials and equipment, will be coordinated with the Navy.

4.6.3.7 Decontamination and Release of Equipment and Tools

Decontamination of mobilized materials and equipment may be necessary at completion of fieldwork if radioactive materials above RGs are encountered. Numerous decontamination methods are available for use. If practical, manual decontamination methods should be used. Abrasive methods may be necessary if areas of fixed contamination are identified. Chemical decontamination can also be accomplished by using detergents for nonporous surfaces with contamination present. Chemicals should be selected for decontamination that will minimize the creation of mixed waste.

4.6.3.8 Remediation of Contaminated Building Surfaces

Following the identification and characterization of contaminated building surfaces, remediation may be required so that residual radioactivity meets the respective RAOs. Specific remediation or decontamination techniques selected will depend on contaminant, type of surface, and other site-specific factors. Type of decontamination that may be performed include concrete scarifying or scabbling, application of strippable surface coatings, and bulk removal of building components. Remediation will be conducted in building areas that exceed RGs and background. Confirmation alpha and beta fixed and removable surface measurements will be collected where remediation is performed to verify that contamination has been removed.

4.6.4 Demobilization

Demobilization will consist of surveying, decontaminating, and removing equipment and materials used during the investigations; cleaning and inspecting the project site and removing temporary facilities. Survey of equipment and materials will be performed (Section 6.6) and decontamination will be performed (Section 3.6.7.2). Demobilization activities will also involve collection and disposal of contaminated materials, including decontamination water and disposable equipment for which decontamination is inappropriate.

5.0 DATA EVALUATION AND REPORTING

Data from the radiological investigation will be evaluated to determine whether the site conditions are compliant with the respective RAOs. If the residual ROC concentrations are below the RGs in the RODs (Navy, 2009a, 2009b, 2010, 2014) or are shown to be NORM or anthropogenic background, then the site conditions are compliant with the RAOs.

Radiological surveys will include scans, static measurements, and samples. Scan measurements are used to identify potential areas of elevated radioactivity for investigation via biased samples and/or static measurements, and are not used to directly demonstrate compliance with the RAOs. Sample and static measurement results at systematic, random, and biased locations are used to evaluate compliance with the RAOs. A separate compliance decision will be made for each ROC for each sample and static measurement.

In general, the following actions will occur during data evaluation and reporting:

- Scan data will be evaluated to identify potential areas of elevated activity for additional investigation, as follows:
  - — Confirm that required scan surveys have been performed on accessible surfaces (Section 3.0 [soil] and Section 4.0 [building]).
  - — DQA will be performed on scan data (Section 5.2).
  - — Potential areas of elevated activity will be identified (Section 5.3.1).
  - — Potential areas of elevated activity will be investigated (Section 5.3.2).
- Soil sample and static measurement data will be evaluated to determine whether site conditions comply with the RAOs, as follows:
  - — Confirm that required soil samples have been collected from systematic and biased locations (Section 3.0) and required building measurements have been performed (Section 4.0).
  - — Confirm that samples have been submitted to the laboratory and backup samples have been archived in a secure area under chain-of-custody protocols.
  - — Confirm that laboratory analyses have been performed (SAP [Appendix B]).
  - — Analytical data will be validated by an independent third party.
  - — DQA will be performed (Section 5.2).
  - — Sample and direct measurement results will be compared to the appropriate RBA data from HPNS (Section 5.5).

- Samples with gamma spectroscopy results that exceed the RG and the expected range of background for ^{226}Ra will be analyzed for ^{238}U, ^{234}U, ^{230}Th, and ^{226}Ra to evaluate the equilibrium status of the uranium natural decay series to determine whether ^{226}Ra is NORM (Section 5.6).
- Results of the investigation will be documented (Section 5.7).

5.1 Data Quality Validation

Analytical data validation will be performed by an independent third party (SAP [Appendix B]). Data validation will be performed on SU and RBA data.

5.2 Data Quality Assessment

The DQA is a scientific and statistical evaluation that determines whether the survey data are the right type, quantity, and quality to support the survey objectives. The following five steps make up the DQA process:

1. Review the DQOs and survey design
2. Conduct a preliminary data review
3. Select the statistical test
4. Verify the assumptions of the statistical test
5. Draw conclusions from the data

The effort expended during the DQA should be consistent with the graded approach used to develop the survey design. The DQA process will be applied to SU and RBA data.

5.2.1 Review the Data Quality Objectives and Survey Design

The sampling design and data collection documentation will be reviewed for consistency with the DQOs. At a minimum, this review will include:

- Number of soil samples or measurements in each SU
- Location of soil samples and measurements
- Measurement technique (i.e., scan, static, sample, swipe) and instrumentation
  - Measurement uncertainty
  - Detectability (critical level and MDC)
  - Quantifiability
- Statistical power

The purpose of the review should focus on identifying the information required to complete the evaluation of the data, the determination of whether the survey objectives were achieved will be completed during Step 5 of the DQA process.

5.2.2 Conduct a Preliminary Data Review

A preliminary data review will be conducted to learn about the structure of the data by identifying patterns, relationships, or potential anomalies. The preliminary data review will include calculating statistical quantities, preparing posting plots of scan and sample data, preparing histograms of scan and sample data, preparing quantile-quantile (Q-Q) plots of scan and sample data, preparing box plots of scan and sample data, preparing retrospective power curves, and analysis of data distributions.

If additional data evaluation tools are used to support conclusions concerning compliance with the RAOs, the report will provide a complete description of the evaluation performed and assumptions used. For example, if a contour plot is provided to describe site conditions, the report would contain a description of the contouring technique used, a list of parameter values and assumptions used to prepare the contour plots, a copy of the contour plot, and an interpretation of the contour plot relative to compliance with the RAOs.

5.2.2.1 Convert Survey Results

The RGs for soil are stated in units of pCi/g, and soil sample results from analytical laboratories will be reported in units of pCi/g, so no conversion will be necessary for soil sample data.

The RGs for buildings surfaces are stated in units of dpm per 100 cm^2; however alpha and beta static measurement results will be reported in units of counts during a specified counting interval. Alpha and beta measurements will be converted into dpm per 100 cm^2 to compare against the RGs. Instrument-specific total efficiencies and material-specific backgrounds will be determined in the field, along with instrument-specific ILs corresponding with the RGs for alpha and beta static and scan measurements on building surfaces.

Once survey results and RGs are available in the same or comparable units, evaluation of the data can continue.

5.2.2.2 Calculate Statistical Quantities

The mean, median, standard deviation, minimum, and maximum for each data set will be reported. Other statistical quantities that may be reported to describe individual data sets include percentiles (25^{th} and 75^{th} for interquartile range, 95^{th} and 99^{th} for upper bound estimates), skewness (a measure of deviation from normal), coefficient of variation, and total number of data points in the data set.

5.2.2.3 Prepare Posting Plots

Posting plots are maps on which measurement results are shown at the location where the measurement was performed. Posting plots will be prepared for scan survey data, and static and swipe data from biased, systematic, and random locations on building surfaces. Posting plots of soil sample locations may also be prepared for Phase 1 trenches, and Phase 2 trenches. Posting plots will be prepared for each SU but are not required for each RBA.

Posting plots are inspected to identify patterns or inconsistencies in the data, especially potential areas of elevated activity requiring additional investigation or spatial trends identifying survey data that are not independent, violating the assumptions of the statistical tests. Posting plots may be prepared using counts, count rates, concentrations, or normalized data (standard deviations or Z-scores) allowing comparison of results from multiple detectors or different measurement methods. Posting plots are most useful when presented in the same units as the RGs or ILs being evaluated.

5.2.2.4 Prepare Histograms

Histograms, or frequency plots, are used to examine the general shape of a data distribution. Histograms will be prepared for scan survey data, static and smear survey data from systematic and random locations, and soil sample data from systematic locations for each SU and RBA. Biased survey data do not need to be included when preparing histograms; however, care should be taken when interpreting histograms that include data collected from biased locations. Histograms reveal obvious departures from symmetry, including skewness, bimodality, or significant outliers.

5.2.2.5 Prepare Q-Q Plots

Q-Q plots compare a data distribution to an assumed normal distribution. Q-Q plots will be prepared for scan survey data, static and smear survey data from systematic and random locations, and soil sample data from systematic locations for each SU and RBA. Biased survey data do not need to be included when preparing Q-Q plots; however, care should be taken when interpreting Q-Q plots that include data collected from biased locations.

Background data usually approximate a normal distribution, so comparing SU data to a normal distribution is one technique in comparing survey data to background. Data from a normal distribution appear as a straight line on a Q-Q plot, so deviations from a straight line indicate potential deviations from a normal distribution, or potential deviations from background. Normal probability plots from different data sets (such as a SU and an RBA or adjacent SUs) can be shown on the same graph to allow for direct comparisons between multiple data sets.

5.2.2.6 Prepare Box Plots

Box plots are a nonparametric graphical depiction of numerical data based primarily on quartiles (25^{th}, 50^{th}, and 75^{th} percentiles). Box plots may include whiskers showing extreme values, usually the minimum and maximum. Box plots may also show outliers as individual points. The ends of the whiskers and selection criteria for outliers are not standardized and may represent different values depending on the underlying assumptions.

Box plots provide visual estimates of dispersion and skewness for a data set including the range, interquartile range, and median. Box plots from different data sets (i.e., an SU and a RBA or adjacent SUs) can be shown on the same graph to allow for direct comparisons between multiple data sets.

5.2.2.7 Prepare Retrospective Power Curves

A retrospective power curve provides an evaluation of the survey design and is used to demonstrate enough data were collected to support decisions regarding the radiological status of the SU. Retrospective power curves will be prepared for static and smear survey data from systematic and random locations, and soil sample data from systematic locations for each SU. Biased survey data will not be included when preparing retrospective power curves. The retrospective power curve is compared with the DQOs and the Type II decision error rates to evaluate whether a sufficient number of samples was collected.

No statistical tests are required for individual data sets because compliance with the RAOs is based on point-by-point comparisons. Because the number of measurements per SU was determined assuming that a statistical test would be performed, the retrospective power curve assists in determining whether the survey design was adequate and is not directly related to compliance decisions.

5.2.2.8 Analysis of Data Distributions

The distribution of data within a data set can provide important information during data evaluation. Determining the type of distribution may be important for selecting additional evaluation tools to answer specific questions about individual data sets. The analysis of data distributions for this investigation may be used primarily for establishing maximum likelihood estimate values for RBA data sets.

Environmental data are most often associated with three distributions: normal, lognormal, or gamma. Statistical tests to identify a distribution have a null hypothesis that the data set comes from the distribution being tested. This means there must be sufficient evidence showing that the data do not follow a specific distribution before the initial assumption is rejected. For this reason, it is not unusual for a data set to be associated with more than one type of distribution. Moreover, negative values in a data set cannot provide results for analyzing lognormal or gamma distributions.

Individual data sets will be analyzed to determine whether the data appear to follow a normal, lognormal, or gamma distribution at a 5 percent significance level using software (such as *ProUCL*). Data sets that do not follow at least one of these distributions will be identified as not following known distribution and will be evaluated using nonparametric tools and tests.

5.2.3 Draw Conclusions from the Data

Figures 12 and 13 present an overview of how decision for soil and building data, respectively, are combined to draw a conclusion on compliance with the RAOs. Each sample and static measurement result will be compared to the corresponding RG. If residual ROC concentrations are less than or equal to the corresponding RG, then site conditions comply with the RAOs.

Sample and measurement data will be compared to appropriate RBA data from HPNS, and multiple lines of evidence will be evaluated to determine whether site conditions are consistent with NORM or anthropogenic background. The data evaluation may include population-to-population comparisons, graphical comparisons, and comparison with regional background levels. If residual ROC concentrations are determined to be consistent with NORM or anthropogenic background, site conditions comply with the RAOs.

Each ^{226}Ra gamma spectroscopy results exceeding the ^{226}Ra RG and outside the expected range of background will be compared to concentrations of other radionuclides in the uranium natural decay series from the same sample. If the concentrations of radionuclides in the uranium natural decay series are consistent with the assumption of secular equilibrium, then the ^{226}Ra concentration is NORM, and site conditions comply with the RAOs.

If the investigation results demonstrate that there are no exceedances determined from a point-by-point comparison with the statistically-based RGs at agreed upon statistical confidence levels, or that residual ROC concentrations are NORM or anthropogenic background, then a RACR will be developed.

If the investigation results demonstrate exceedances of the RGs determined from point-by-point comparison with the statistically-based RGs at agreed upon statistical confidence levels and are not shown to be NORM or anthropogenic background, remediation will be conducted, followed by a RACR. The RACR will describe the results of the investigation, explain remediation performed, compare the distribution of data from the sites with applicable reference area data, and provide a demonstration that site conditions are compliant with the RAOs through the use of multiple lines of evidence including application of statistical testing with agreed upon statistical confidence levels on the background data.

5.3 Investigation of Potential Areas of Elevated Activity

The investigation of potential areas of elevated activity consists of comparing each measurement result from every SU with the ILs. This investigation is performed for measurement results, and scans, static measurements, and samples at systematic, random, and biased locations. The investigation of potential area of elevated activity ensures that unusually high measurement and sample results will receive proper attention, and area with the potential for significant contributions to total dose will be identified.

5.3.1 Identify Potential Areas of Elevated Activity

Scan data, measurement data, and sample data will be evaluated to identify statistical and spatial anomalies indicating potential areas of elevated activity. Alpha and beta scan data will be compared directly to RGs, and gamma scan data will be compared to ILs. Posting plots will be used to identify trends and patterns in the scan data to help in identifying potential areas of elevated activity and support defining the areal extent of potential areas of elevated activity. Histograms and Q-Q plots will be used to identify significant outliers and evidence of multiple distributions to identify potential areas of elevated activity. Sample or measurement exceeding a ROC-specific RG will be investigated as a potential area of elevated activity. In addition, SU areas with multiple lines of evidence indicating a potential increase in localized activity based on posting plots, histograms, and Q-Q plots of scan, static measurement, or sample data will be investigated as a potential area of elevated activity.

If direct measurement or sample results exceed the RG or IL for a specific ROC for locations not identified by scan survey, the scan survey technique will be reviewed and investigated to determine whether the scan survey was implemented correctly and whether the scan methodology met the survey objectives.

5.3.2 Investigate Potential Areas of Elevated Activity

The objective of investigating potential areas of elevated activity is to characterize the ROCs present and the size, or extent of areas of elevated activity. To accomplish this objective, a minimum of one potential area of elevated activity will be investigated in every SU. If no potential areas of elevated activity are identified in a SU, the location of the maximum scan result will be identified as a potential area of elevated activity.

The first step in investigating potential areas of elevated activity is to confirm the measurement or sample results that indicated the potential area of elevated activity. For alpha and beta scans, this may be accomplished by pausing during scanning to collect additional information, or it may require returning to a location to perform a biased static measurement. For gamma scans this may involve rescanning the area surrounding the potential elevated reading, sifting through near surface soil for a discrete source of activity, or collecting a biased soil sample for analysis. The selection of the confirmatory action will depend on the initial results and the decision on whether the original results are confirmed. In general, minimal information is acceptable when deciding to continue with the investigation of a potential area of elevated activity. In most cases, at least one measurement or sample result documenting the lack of elevated activity will be required to support a decision to conclude the investigation of a potential area of elevated activity.

Once the presence of an area of elevated activity has been confirmed, the ROCs present will be identified. For building surfaces, it is sufficient to identify the elevated activity as alpha, beta, or a combination of alpha and beta radiation. For soil samples, it is generally necessary to identify the radionuclide based on laboratory analysis.

The final step in investigating areas of confirmed elevated activity is determining the area, or extent, of the elevated results. The identification of the ROCs present will assist in determining whether additional data are required to determine the extent of elevated activity, and the number and type of measurements or samples that will be used for that determination. For building surfaces, the posting plot of the scan data is generally what is needed to determine the extent of elevated readings. The determination may be accomplished similarly for soil areas when the ROC is ^{226}Ra and the elevated activity is readily detected by scan surveys. Determining the extent of elevated activity for ROCs without a significant gamma emission (such as ^{90}Sr) will require collecting additional soil samples. For SFUs with elevated activity requiring further investigation, the entire surface area of the SFU will be investigated. The results of the investigation should identify an area of elevated activity bounded by measurements or sample results below the RGs or ILs.

If alpha or beta static measurement of ROC-specific soil sample analysis results are less than the RGs and/or background, compliance with the RAOs is achieved.

5.4 Comparison to RG Values

The RODs (Navy, 2009a, 2009b, 2010, 2014) establish RGs for soil and building surfaces. Table 5 provides these RG values. The ^{226}Ra RG for soil is applied in addition to background. For ^{90}Sr and ^{137}Cs, the soil samples will be compared to the RG or background, whichever is higher.

Analytical data from systematic and biased surface and subsurface soil sample results will be compared directly with the RGs and/or background. Each soil sample will have gamma spectroscopy data for ^{137}Cs (reported from is 661-keV peak) and ^{226}Ra (reported using the 609-keV gamma emission from bismuth-214 following a 21-day ingrowth period). For soil SUs, 10 percent of samples will have analysis for ^{90}Sr performed. These results will be compared directly with the RGs and/or background to determine compliance with the RAOs.

^{137}Cs is considered to be the indicator for fission product radionuclides associated with Naval Radiological Defense Laboratory activities. The limited number of systematic samples analyzed for ^{90}Sr will serve to supplement the investigation. Sample results above the ^{137}Cs RG/background will trigger additional analyses in the same sample for ^{90}Sr. The results of these additional analyses will be compared directly against the RGs and/or background. Based on the inability to perform gamma scanning for these radionuclides at the RG, demonstrating compliance with the RAOs will be based on soil sample analytical results.

Table 5 lists the RGs for building surveys. Static measurement results will be provided for total alpha and total beta activity and are not radionuclide-specific. Therefore, the lowest RG values for alpha and beta-emitting ROCs will be selected. Total alpha and total beta results will be corrected for material-specific background and reported as net activity above the mean activity for that material from the RBA representing background for a specific building, on a specific material, using a specific detector. The net total activity will be compared directly with the corresponding RG.

If sample and direct measurement results are less than or equal to the corresponding RG, then the site conditions are compliant with the RAOs and a RACR can be prepared (Section 5.7).

5.5 Comparison to Background

Sample and static measurement data shown to be NORM or anthropogenic background comply with the RAOs, even if the results exceed the corresponding RG value. In addition, to address California Department of Public Health requirements for radiological release specified in California Code of Regulations Title 17, Section 30256, a comparison of site data with background will be performed.

RBA data sets for soil will be developed or selected from existing RBA data sets determined to be representative of soil at HPNS in accordance with the *Final Background Soil Study Report, Base Realignment and Closure, Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California* (CH2M Hill, Inc., 2020). RBA data sets for building surfaces will be developed (Section 4.4.2) to provide building-specific, material-specific, and instrument-specific RBA data. Final selection of RBA data sets will be reviewed by the Navy, EPA, and the State of California.

The comparison of site data with background may include, but is not limited to, the following:

- Population-to-population comparisons. Site data sets may be compared with RBA data using parametric or nonparametric tests, depending on the distributions of the data. Following the population test performance, the underlying assumptions of the test will be verified.
- Use of maximum likelihood estimate or background threshold value. A point-by-point comparison of site data with the maximum likelihood estimate or background threshold value may be performed if RBA data allow for calculation of those values. Maximum likelihood estimate would be calculated using *ProUCL*.
- Graphical comparison. Graphical representations of site and RBA data may be useful in visually comparing two or more data sets. Typical graphical tools include histograms, box-and-whisker plots, and probability plots.
- Comparison with regional background levels. As previously noted, much of HPNS was constructed using fill materials from off-site sources. As such, soil conditions at the site are heterogeneous, and the on-site RBAs may not accurately capture background levels of ROCs for soil types that may be present at HPNS. Where appropriate, available RBA data from other sources may be used for comparison with site data.

If residual ROC concentrations are consistent with NORM or anthropogenic background, site conditions comply with the RAOs. If ^{226}Ra gamma spectroscopy results for soil exceed the RG and the expected range of NORM concentrations, the equilibrium status of the uranium natural decay series will be evaluated for the sample (Section 5.6).

5.6 Determine Equilibrium Status

The RBA data set for ^{226}Ra and other naturally-occurring ROCs will be selected to represent as much of the soil at HPNS as practical. However, the history of HPNS shows that a wide variety of fill materials have been used as part of construction and maintenance activities over the life of the site. These fill materials may have a range of naturally-occurring radioactivity, so an incorrect identification of fill material could result, with higher levels of NORM being identified as contamination. To avoid this situation, additional evaluation may be performed for samples in which the ^{226}Ra gamma spectroscopy result exceeds the RG plus background, but the sample could still indicate association with NORM instead of contamination.

The uranium natural decay series is one of the primordial natural decay series that are collectively referred to as NORM. The members of the uranium natural decay series are present in background at concentrations that are approximately equal, a situation referred to as secular equilibrium. Secular equilibrium for the uranium natural decay series is established over hundreds of thousands of years. Concentrations of ^{226}Ra higher than the concentrations of other members of the uranium natural decay series may indicate contamination, while ^{226}Ra concentrations consistent with other members of the series indicate natural background.

Determining the equilibrium status of the uranium natural decay series requires analyzing a sample for multiple radionuclides from the series using the same or comparable analytical techniques. Observed differences in concentrations result primarily from differences in concentrations, and the uncertainty is primarily associated with the analysis.

Radionuclides from the uranium natural decay series with ^{226}Ra as a decay product (i.e., ^{238}U, ^{234}U, ^{230}Th) will be analyzed by alpha spectroscopy, along with ^{226}Ra. It is not necessary to analyze for the decay products of ^{226}Ra because these radionuclides re-establish secular equilibrium with ^{226}Ra over a period of several weeks. In addition, most of the ^{226}Ra decay products are not readily analyzed by alpha spectroscopy. If practical, the analyses will be performed using the same sample aliquot to reduce sampling uncertainty. The results of the four analyses will be compared. If the ^{226}Ra result is similar to the results for the other radionuclides, the ^{226}Ra activity is NORM and complies with the RAOs, and the equilibrium determination will be documented in the RACR. If the ^{226}Ra result is significantly greater than the results for the other radionuclides and exceeds the RG plus background, the elevated ^{226}Ra may be attributed to site contamination, and remediation may be required.

5.7 Reporting

Results of radiological investigations for buildings and trenches complying with the RAOs will be documented in a RACR, and the buildings and trenches will be recommended for unrestricted radiological release. The RACR will describe the results of the investigation, provide visualizations of spatially correlated data, explain remediation performed, compare the distribution of data from the sites with applicable reference area data, and provide a demonstration that site conditions are compliant with the RAOs. The final status survey results, including a comparison to background and discussion of remedial activities performed as part of the investigation, will be included as an attachment to the RACR.

If the investigation results should demonstrate that Parcel conditions are not compliant with their respective RAOs, a removal site evaluation report will be developed. The site investigation report will include recommendations for further action based on the most current EPA guidance.

6.0 RADIOACTIVE MATERIALS MANAGEMENT AND CONTROL

This section presents project requirements, including personnel roles and responsibilities, required training, and health and safety protocols.

6.1 Project Roles and Responsibilities

The SAP organization chart (Appendix B) presents the personnel responsible for the execution of site activities and program oversight.

6.2 Licensing and Jurisdiction

For radiological activities at HPNS, APTIM will invoke NRC License 20-31340-01 and California State Radiological License 7889-07. APTIM will also establish areas of control under a Memorandum of Understanding (MOU) with the HPNS LLRW brokering company and other Navy radiological contractors, as required. The intent of the MOU is to outline the general applicability and responsibilities of each entity as applicable to the corresponding work scope and license compliance parameters.

6.3 Radiation Protection Program

The RPP (APTIM, 2019b) defines the requirements for radiological protection performed by APTIM on this project. An overview of the performance of radiological hazard analysis and controls, performance of radiological surveys, external dosimetry, and other matters regarding radiation protection is presented in the RPP. For radiological activities at HPNS, APTIM will invoke NRC License 20-31340-01 and California State Radiological License 7889-07. APTIM will also establish areas of control under a MOU with the HPNS LLRW brokering company and other Navy radiological contractors, as required. The intent of the MOU is to outline the general applicability and responsibilities of each entity as applicable to the corresponding work scope and license compliance parameters.

APTIM's policy is that radiological work, including work with radioactive materials or ionizing radiation, be purposeful and performed in a manner that protects workers, members of the public, and the environment. Exposures to ionizing radiation and releases of radioactive material will be managed to reduce individual and collective doses to workers and the public and ensure that exposure is as low as reasonably achievable (ALARA). Work involving radiological hazards may not begin unless that work can be performed in a safe manner, compliant with rules and regulations. Moreover, APTIM endorses and applies ALARA principles. The ALARA principles are integrated into activities described in this WP and will be implemented during the course of the work carried out under this WP.

Project participants with the authorization to enter a posted restricted area must successfully complete site-specific radiation worker training. The participants must also be briefed on the RPP (APTIM, 2019b) and sign an acknowledgement that the participant read and understands the requirements.

Employees working at the site have authorization to stop work if an unsafe condition exists or a safety procedure is being disregarded in accordance with AMS-710-05-PR-00400, “Stop Work Authority” (APTIM, 2020b).

6.4 Radiological Work Permits

RWPs will be prepared in accordance with AMS-710-07-WI-04009, “Radiological Work Permits” (APTIM, 2020b) and amended, if applicable, to address the activities to be performed in radiological areas and will include radiological conditions and safety requirements for the activities. Personnel assigned to site work will be required to read and sign the RWP acknowledging that they understand the requirements of the RWP prior to beginning work. The RWPs identify the requirements for entering, exiting, and conducting work in radiologically posted areas.

6.5 Radiological Control Area Establishment and Control

One or more RCAs will be established as necessary around work areas and delineated with temporary fencing or caution tape, or equivalent, and have the appropriate warning signage posted. Ingress and egress control points will be established and maintained. Radiological screening of personnel, equipment, and materials will be required when exiting the RCA. Work performed in or near roadways will be coordinated with the task-related site supervisor and other site users to implement appropriate traffic control and road closures as needed for site personnel safety. The RCA will be posted consistent with the requirements of the RPP (APTIM, 2019b).

Routine surveys and inspections will be performed along the RCA fence line consisting of dose rate measurements and visual inspections. Surveys will be performed to ensure that there is no change in exposure measurements in accessible areas that could negatively impact the public or environment. Observed breaches in the fence will be promptly repaired.

6.6 Documentation and Records Management

The purpose of this subsection is to define standards for the maintenance and retention of radiological records. Radiological records provide historical data, document radiological conditions, and record personnel exposure. The SAP (Appendix B) outlines field documentation requirements.

Radiological surveys will be performed and documented in accordance with the RPP (APTIM, 2019b). Sample collection, field measurements, and laboratory data will be recorded electronically to the extent practicable. Electronically recorded data and information will be backed up to an APTIM SharePoint site or equivalent on a nightly basis, or as reasonably practical. Data and information recorded on paper will be recorded using indelible ink. Both electronic and paper records of field-generated data will be reviewed by the PRSO or a designee knowledgeable in the measurement method for completeness, consistency, and accuracy. Data manually transposed to paper from electronic data collection devices will be compared to the original data sets to ensure consistency and to resolve noted discrepancies. Electronic copies of original electronic data sets will be preserved on a nonmagnetic retrievable data storage device. No data reduction, filtering, or modification will be performed on the original electronic versions of data sets.

6.6.1 Documentation Quality Standards

Records will be legible and completed with an indelible ink that provides reproducible and legible copies. Records will be dated and contain a verifiable signature of the originator. Errors that may be identified will be corrected by marking a single line through the error and by initialing and dating the correction.

Radiological records will not be corrected using an opaque substance. Shorthand or nonstandardized terms may not be used.

To ensure traceability, each record will clearly indicate the following:

- Name of the project
- Specific location
- Function and process
- Date
- Document number (if applicable)

The quantities used in records will be clearly indicated in standard units (e.g., curie, radiation absorbed dose, roentgen equivalent man, dpm, becquerel), including multiples and subdivisions of these units.

6.6.2 Laboratory Records

The contractor QC plan (Appendix C) includes survey and laboratory data assessment records will be.

6.6.3 Record Retention

Records resulting from implementation of this WP will be retained, as outlined in the SAP (Appendix B).

7.0 WASTE MANAGEMENT PLAN

This section describes the type of waste expected to be generated and the management, transport, and disposal of the material.

7.1 Project Waste Descriptions

Waste generated during this investigation may be radiological in nature. It is anticipated that the following waste streams will be generated and managed (Table 8).

The following subsections address specific control and management practices for LLRW and non-LLRW. Waste determined to be non-LLRW will be transported and disposed of by the contractor. LLRW will be transferred to the Navy's radiological waste contractor and disposed of off site, in accordance with the MOU.

7.2 Radiological Waste Management

Waste materials deemed to be radioactive waste will be managed in accordance with applicable license procedures.

7.2.1 Waste Classification

Accumulated waste deemed to be radioactive waste will be classified as LLRW based on 49 CFR, basewide requirements, or disposal facility requirements. Waste characteristics, including the radionuclides present and their associated specific activities, will be measured by an available standardized test method (SAP [Appendix B]) (such as gamma spectroscopy, strontium analysis, or alpha spectrometry).

7.2.2 Waste Accumulation and Storage

Soil, debris, water, and materials classified as LLRW may be generated during sampling. When classified as LLRW, these wastes may be placed in containers provided by the Navy (e.g., 55-gallon drums, super sacks). When filled, LLRW containers will be transferred to the custody and control of the Navy's radiological waste contractor, who will provide brokerage services including waste characterization sampling, transportation, and disposal in accordance with federal regulations and disposal facility requirements. Containers will be radiologically surveyed when filled with material. Each container will be properly inventoried and labeled. Inventories will include material description and isotopic identification, and hazardous components, if appropriate. The contents of each container will be recorded in the field logbook, and each container will be assigned a unique identification number.

Containers will be stored in a designated and posted radioactive material storage area under the authority of the Navy's radiological waste contractor's California Radioactive Material License. Storage areas may be at the site where the waste originated or another location as directed by the Navy.

Containers will be secured to prevent unauthorized access to their contents. Once filled, containers will be surveyed, and surface radiation dose rate measurements will be collected.

7.2.3 Labeling and Posting of Containers Containing Radioactive Waste

Each waste container containing LLRW will be labeled. The activity contained in each waste container will be reported in pCi/g, and maximum contact radiation levels will be measured in milliroentgens per hour. Following the surveying and labeling, the waste container will be placed in a designated and posted radioactive area. The container area will be posted with a “Caution – Radioactive Materials Area” posting. An inventory of contents with radionuclide and specific activity (if available) will be maintained by the contractor until the custody of the material is transferred to the Navy’s radiological waste contractor.

7.2.4 Waste Accumulation Areas

The following requirements will be implemented for radioactive waste stored on site within a designated radioactive materials area:

- Industry standard posting and barrier materials will be displayed with wording that includes the following, “Caution – Radioactive Materials Area,” at each radioactive waste storage area sufficient to be seen from an approach. The signs will be legible and clearly conspicuous for outdoor and indoor locations.
- Aisle space will be maintained to allow for the unobstructed movement of personnel, fire control equipment, spill control equipment, and decontamination equipment to a facility operation area, in the event of an emergency, unless aisle space is not needed for these purposes.
- The areas will be secured to prevent unauthorized access to the material.
- The following emergency equipment will be located or available to personnel during radioactive waste management activities as each accumulation area:
    - A device (such as a telephone or handheld two-way radio) capable of summoning emergency assistance (adjacent areas with personnel who have communication devices or areas with fixed devices that personnel can access quickly are sufficient)
    - Portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment
    - Filled containers generated during performance of work will be stored in a material storage location until the contained material can be characterized and appropriately classified. Depending on the characterization results, the material may be moved to another storage location, transported and disposed of off site, or reused as backfill.

7.2.5 Inspection of Waste Accumulation Areas

While waste accumulation areas will be informally inspected daily during waste generation activities, formal inspections of container accumulation areas will be conducted and recorded at least weekly in accordance with the Radioactive Material License requirements. The PRSO or designee will conduct inspections that will be recorded in a dedicated field logbook and a weekly inspection checklist will be completed. The container storage areas will be inspected and the containers checked to ensure the following:

- Containers will be checked for condition. If a container is not in good condition, the certified waste broker will be informed.
- Containers will be checked to ensure that they remain closed and secured, except when adding or removing waste.
- Container label will be checked to ensure that it is visible and filled out properly.

7.2.6 Waste Transportation

In accordance with the MOU, the Navy's radiological waste contractor will be responsible for transportation of the LLRW in accordance with the U.S. Department of Transportation (DOT) Radioactive Material Transportation regulations of 49 CFR for off-site disposal. The contractor may supply DOT contamination surveys and radiation measurements on the outside of the container prior to shipment. The Navy's radiological waste contractor will ensure that empty containers being returned to vendors meet the release limits for equipment and materials.

LLRW transported from the site will be accompanied by a radioactive waste manifest or a uniform hazardous waste manifest, as appropriate. Preparation of the LLRW manifests are the responsibility of the Navy's radiological waste contractor.

BRAC will receive a copy of the manifests. The remaining copies will be given to the transporter. The manifest will be returned to the Navy signatory official in accordance with the HPNS recordkeeping requirements.

7.2.7 Waste Disposal

The Navy's radiological waste contractor is responsible for the disposal of LLRW. The Navy's radiological waste contractor will coordinate closely with RASO and APTIM to ensure proper transfer of custody of the waste and coordinate the shipment off site. LLRW inventories will be managed under the appropriate Radioactive Material License.

7.3 Nonradiological Waste Management

The following subsections discuss nonradiological waste management.

7.3.1 Waste Classification

In general, wastes generated during the project will be assessed to determine proper handling and final disposition through chemical analysis, field testing, and possible generator knowledge. The exceptions are uncontaminated wastes (i.e., no contact with contaminated media or remediation chemicals) and trash.

Samples of these wastes will be collected and analyzed to determine whether the waste is a hazardous waste or a nonhazardous waste. Analysis will be based on the requirements of the off-site disposal facility and may include total petroleum hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds, pH, or California Assessment Manual 17 total metals. Based on the results, additional waste characterization may be needed or necessary to have the waste managed at an off-site waste management facility.

Samples will be collected in accordance with the general procedures in the following subsection and sent to a properly licensed laboratory for analyses. If the waste is placed in containers, one composite sample (and one grab sample for VOC analysis, if needed) will be collected for every 10 drums of each waste stream. If soil is staged in stockpiles or bins, a 4-to-1 composite will be collected and a grab sample for VOCs. If the waste (liquid) is placed in a tank or container, grab samples are appropriate. Off-site waste management facilities may require specific sampling per volume of waste accumulated under their waste acceptance policy.

7.3.2 Waste Sampling Procedures

The following subsections describe waste sampling procedures.

7.3.2.1 Liquids

Analytical samples for liquid wastes will be collected form the 55-gallon drums before disposal; one composite sample will be collected for every 10 drums. Water samples will be collected as follows:

1. Collect a water sample from a drum using a bailer or dipper if the water is homogenous or use a coliwasa if the water has more than one phase.
2. Fill the sample containers for volatile analyses first. Fill the 40-milliliter vials so there is no headspace in each vial. Fill the sample containers for the remaining analyses.
3. Label and package the sample containers for shipment to the laboratory.

7.3.2.2 Solids

For soil, one grab sample and one composite sample will be collected for every 10 drums. Soil sample procedures for collecting VOC samples are as follows:

1. Retrieve a core from the selected sample location.
2. Fill the appropriate sample jars completely full, with the sample from the core.

Soil sample procedures for collecting nonvolatile or metal samples are as follows:

1. Collect equal spoonfuls of soil from five randomly selected points and transfer into a stainless-steel bowl.
2. Use a stainless-steel spoon and quartering techniques to homogenize the five samples.
3. Fill the appropriate sample jars completely full, with the homogenized sample.
4. Close the jars, label them, complete chain-of-custody documentation, and package them for shipment to the laboratory.

7.3.3 Waste Profile

Waste characterization information will be documented on a waste profile form provided by the off-site treatment or disposal facility and will be reviewed before being submitted to the Navy. The profile will be reviewed, approved, and signed by the appropriate Navy personnel. Signed profiles will then be submitted to the designated off-site facility.

The profile typically requires the following information:

- Generator information, including name, address, contact, and phone number
- Site name, including street/mailing address
- Process-generating waste
- Source of contamination
- Historical use for area
- Waste composition (e.g., 95 percent soil and 5 percent debris)
- Physical state of waste (e.g., solid, liquid)
- Applicable hazardous waste codes
- DOT proper shipping name

APTIM will coordinate with the disposal subcontractor to schedule the transportation of the waste to the off-site disposal facility after the copy of the approved waste profile is received.

7.3.4 Container Labeling

Waste containers containing contaminated media will be marked and labeled upon use concerning their contents. Each hazardous waste container will be marked in accordance with 22 California Code of Regulations 66262.32. In addition, containers will be labeled and in accordance with DOT 49 CFR 172.300 (Marking) and 172.400 (Labeling) and 40 CFR Subpart C. DOT labeling is only required before offering transportation off site.

Markings will note the type of waste, location from which the waste was generated, and accumulation start date. One of the following labels will be used:

- “Analysis Pending” or “Waste Material”: Temporary label until analytical results are received, reviewed, and determined whether the waste is hazardous or not. This label will include the accumulation start date. An example of this mark is provided as follows:
  - Contents: Example—soil from drill/auger cuttings
  - Origin of materials: “Former Hunters Point Naval Shipyard”
  - Address
  - Contact name and phone number
  - Accumulation start date
- “Nonhazardous Waste”: If the waste is determined to be nonhazardous, apply the mark with the following information:
  - Shipper: “Former Hunters Point Naval Shipyard”
  - Address
  - Contents
  - Contact name and phone number
  - Add accumulation start date somewhere on the mark
- “Hazardous Waste”: If the waste is determined to be hazardous, apply the mark with the following information:
  - Name: “Former Hunters Point Naval Shipyard”
  - Address
  - Phone
  - City
  - State
  - Zip

— EPA identification No.

— Manifest number

— EPA waste No.

— CA waste No.

— Accumulation start date

— Physical state

— Hazardous properties

— DOT proper shipping name

7.3.5 Waste Accumulation Areas

Although hazardous waste is not expected, if generated, the contractor will coordinate with the Navy to determine an appropriate site location to store the hazardous waste.

Containers will be physically handled in accordance with the APP/SSHP (APTIM, 2019a). Additional management requirements for the drums or small containers are as follows:

- Inspected upon arrival on site for signs of contamination or deterioration. Container arriving with contents or in poor condition will be rejected.
- No penetrating dents are allowed that could affect the integrity of the drum. Special attention paid to dents at the drum seams.
- Closed head drums will be inspected to verify that the bung will close properly.
- Open head drum lids will be inspected to verify that the gasket is in good shape and that the lid will seat properly on the drum.
- Arranged in rows of no more than two drums with at least 3 feet between rows.
- Each container will be provided with its own mark and label, and the marks and labels must be visible.
- Drums will remain completely closed with lids, covers, bolts, and locking mechanisms engaged, as though ready for immediate transport, except when removing or adding waste to the drum.
- Drums and small containers of hazardous waste will be transported using proper drum-handling methods (such as transportation by forklift on wood pallets) with drums secured together. Containers will be transported in a manner that will prevent spillage or particulate loss to the environment.

- Drums will be disposed of with the contents. If the contents are removed from the drums for off-site transportation and treatment or disposal, the drums will be decontaminated prior to reuse or before leaving the site.
- The outsides of the drums and containers must be free of hazardous waste residues.
- Ignitable or reactive wastes will be stored at least 50 feet from the property line.
- Drums and containers will not be located near a stormwater inlet or stormwater conveyance.
- Drums containing waste liquids, hazardous or incompatible wastes will be provided with secondary containment capable of holding the contents of the largest tank and precipitation from a 24-hour, 25-year storm.
- Liquid that accumulates in a secondary containment area will be removed and placed in containers within 24 hours. Removed liquids with a sheen will be characterized and classified.
- New empty drums will be marked with the word “Empty.” Drums that are being reused will be marked with “Empty, last contained [previous contents].”
- Containers will be tracked on the field transportation and disposal log.

7.3.6 Inspection of Waste Accumulation Areas

Waste container accumulation areas will be inspected at least weekly for conditions that could result in a release of waste to the environment. Inspections will focus on conditions (such as equipment malfunction, container or containment deterioration, and signs of leakage or discharge). Specifically, containers (drums and roll offs) will be inspected for leaks, signs of corrosion, or signs of general deterioration.

Deficiencies observed or noted during inspection will be corrected immediately. Appropriate measures may include transferring waste from a leaking container to a new container, replacing the liner or cover, or repairing the containment berm.

Inspections will be recorded in the project logbook or on an inspection form. Deficiencies and corrections will also be documented. The following items will be noted in the logbook for each inspection:

- The location of the area
- Total number of containers present
- Date
- Verification that containers are labeled with the accumulation start date, contents, HPNS point of contact, and relevant hazards (such as flammable and oxidizer) (labels must be visible, legible, and not faded)

- Condition of containers (good condition for containers is defined as no severe rusting, dents, defects, or leaks)
- Condition of secondary containment (good condition for containment is defined as no structural defects or leaks)
- Verification that containers are completely closed with bolts, lids, and locking mechanisms engaged as though ready for immediate transport
- Verification that containers are staged in rows not more than two drums wide, with labels facing outward, and 3 feet of space between rows
- Verification that containers are being tracked on the transportation and disposal log
- Verification that accumulation area is clean and free of debris
- Verification that emergency response equipment is present if required for the waste being staged

7.3.7 Waste Transportation

Each transportation vehicle and load of waste will be inspected before leaving the site, and the inspection will be documented in the logbook. The quantities of waste leaving the site should be recorded on a transportation and disposal log. A subcontractor licensed for commercial transportation will transport nonhazardous wastes. If the wastes are hazardous, the transporter will have an EPA ID No. and will comply with transportation requirements outlined in 49 CFR 171-179 (DOT) and 40 CFR 263.11 and 263.31 (Hazardous Waste Transportation).

The transporter will observe the following practices when hauling and transporting wastes off site:

- Minimize impacts to general public traffic
- Clean up waste spilled in transit
- Line and cover trucks and trailers used for hauling contaminated waste to prevent releases and contamination
- Decontaminate vehicles before reuse

In accordance with the MOU, the Navy’s radiological waste contractor will be responsible for transportation of the LLRW in accordance with the DOT Radioactive Material Transportation regulations of 49 CFR for off-site disposal. The contractor may supply DOT contamination surveys and radiation measurements on the outside of the container prior to shipment. The Navy’s radiological waste contractor will ensure that empty containers being returned to vendors meet the release limits for equipment and materials.

Off-site transportation and disposal of hazardous or solid wastes will be handled by the selected waste contractor. Hazardous waste transported from the site will be accompanied by a uniform hazardous waste manifest and solid (nonhazardous) waste will be accompanied by a nonhazardous waste manifest or bill of lading, as appropriate. Navy personnel will be responsible for reviewing and signing waste documentation, including waste profiles, manifests, and land disposal restriction notifications (manifest packages). Before signing the manifest, the designated Navy official will ensure that pre-transport requirements of packaging, labeling, marking, and placarding are met according to 40 CFR Parts 262.30-262.33 and 49 CFR Parts 100-178.

7.3.8 Waste Disposal

Hazardous and solid wastes will be transported off site for appropriate treatment and disposal. Hazardous waste will be disposed of or managed only at a hazardous waste disposal facility prequalified by the contractor and permitted for the disposal of the particular type of hazardous or solid waste generated.

7.4 Waste Minimization

To minimize the volume of hazardous and radioactive waste generated during the project, the following general guidelines will be followed:

- Waste material will not be contaminated unnecessarily
- Work will be planned
- Material may be stored in large containers, but the smallest reasonable container will be used to transport the material to its destination
- Cleaning and extra sampling supplies will be maintained outside potentially contaminated area to keep them free of contamination and to minimize additional waste generation
- Mixing of detergents or decontamination solutions will be performed outside potentially contaminated areas
- When decontaminating radioactively contaminated material, every effort should be made to minimize the generation of mixed waste
- Contaminated material will not be placed with clean material
- Wooden pallets inside the exclusion zone will be covered with plastic
- Material and equipment will decontaminated and reused when practicable
- Volume reduction techniques will be used when practical

7.5 Compliance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Off-site Rule

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Off-site Rule, wastes generated from remediation activities (such as contaminated soil or hazardous waste) at a Comprehensive Environmental Response, Compensation, and Liability Act of 1980 site may be transferred only to off-site facilities that have been deemed acceptable by EPA regional off-site contact (40 CFR 300.440). With Naval approval, APTIM will request proof of Off-site Rule approval from the off-site disposal facility before transferring wastes to an off-site facility.

Other disposal practices to be followed are as follows:

- Hazardous waste (State and Resource Conservation and Recovery Act [RCRA]) will be sent to an off-site, permitted, RCRA Subtitle C treatment, storage, and disposal facility
- Nonhazardous wastes will be disposed of at an off-site RCRA Subtitle D facility permitted to receive such wastes. It is expected that the contaminated soil and debris will be classified as nonhazardous and disposed of at a Subtitle D facility
- Decontamination water may be discharged to an on-site water treatment facility with written permission from HPNS or disposed of off site at a facility permitted to accept the waste
- Uncontaminated debris may be sent to municipal landfills, landfills designated for construction/demolition debris or a recycling facility
- General trash will be disposed of in dumpsters on HPNS

The designated off-site facility will be responsible for providing a copy of the fully executed waste manifest and a certificate of treatment or disposal for each load of waste received to the generator.

7.6 Documentation

Documentation requirements apply to waste managed during project activities. Waste-generating activities field records will be kept. Pages of the field data record log will be signed and dated by the person entering the data. In addition, the following information will be recorded in the log:

- Description of waste-generating activities
- Location of waste generation (including depth, if applicable)
- Type and volume of waste
- Date and time of generation
- Description of waste sampling
- Name of person recording information

- Name of field manager at time of generation

7.7 Updating the Waste Management Plan

The waste management plan section will be updated as changes in site activities or conditions occur, as changes in applicable regulations occur, and as replacement pages are added to this WP. Revisions to waste management will be reviewed and approved by the Navy. Changes to the plan associated with radioactive or mixed waste will require approval from RASO.

8.0 ENVIRONMENTAL PROTECTION PLAN

This section discusses the environmental protection plan that will be implemented.

8.1 Land Resources and Vegetation

Parcels D-2, UC-1, UC-2, and UC-3 are within a developed former industrial area with limited to no vegetation. The administrative provisions of the applicable permit programs will be applied to protect wetlands and streams, if appropriate.

8.2 Fish and Wildlife, Threatened, Endangered, and Sensitive Species

Several hundred types of plants and animals are believed to live at or near HPNS. No federally listed endangered or threatened species are known to permanently reside at HPNS or in the vicinity. However, San Francisco Bay is a seasonal home to migrating fish and birds.

8.3 Wetlands and Streams

Two freshwater streams, Yosemite and Islais Creeks, flow into San Francisco Bay adjacent to the border with HPNS. Surface water resources at the site are limited to small groundwater seeps from exposed bedrock and the surface water in adjacent San Francisco Bay. The administrative provisions of the applicable permit programs will be applied to protect wetlands and streams, if appropriate.

8.4 Stormwater, Sediment, and Erosion Control

Stormwater, sediment, and erosion control will be managed through the stormwater management plan, (Appendix F) and the use of BMPs.

8.4.1 Stormwater Pollution Prevention

Stormwater pollution prevention, otherwise known as stormwater management, includes measures that can reduce potential stormwater pollution from industrial activity pollutant sources. Stormwater management includes the following BMPs:

- Pollution prevention team
- Risk identification and assessment
- Preventive maintenance
- Good housekeeping
- Site security
- Spill prevention and response

- Stormwater pollution prevention
- Sediment and erosion prevention
- Inspection and monitoring
- Personnel training

These BMPs help to identify and eliminate conditions and practices that could cause stormwater pollution. The stormwater management plan (Appendix F) details the entire program to include the regulatory requirements and methods used to meet these requirements.

Inspections play a significant role in the prevention of releases and pollution of stormwater. Qualified contractors and personnel perform inspections (Appendix F). These inspections will be documented.

8.4.2 Stockpile Control

Stockpiles will be managed to ensure that possible cross contamination with surrounding surfaces will be minimized to the extent possible. These measures will include, at a minimum, the following:

- Excavated material will be placed on plastic to prevent contact with the surface.
- Stockpiles will be covered with plastic or tarps at the end of shift or when stockpile additions or removals are complete and monitored on a weekly basis.
- BMPs (i.e., biodegradable wattles, fiber rolls, erosion berms) will be used around stockpiles to prevent material migration.
- Stockpiling of known hazardous material will not be allowed. Hazardous material will be packaged as hazardous waste and stored under RCRA controls pending removal by a waste broker.

8.4.3 Nonradiological Hazardous Materials

Hazardous material will be managed in accordance with permits, plans, rules, and laws. At a minimum, the following will be required:

- Hazardous material will be properly labeled and stored.
- Hazardous waste will be placed into approved containers and stored in designated Satellite Accumulation Areas or Waste Accumulation Areas.
- Hazardous material or waste containers will be kept closed when not in use.
- Before workers open container or package with hazardous material, the SSHO will be consulted to determine whether pre-entry monitoring is required.

8.5 Air Quality and Dust Control

Intrusive activities will comply with the substantive requirements (Bay Area Air Quality Management District Rule 40 and Regulations 6-305 and 8) pertaining to fugitive dust emissions and maintaining covering and stockpiling materials. Fugitive emissions will be minimized to the extent possible. Subsurface soil within the HPNS is expected to be moist and not require dust suppression. These measures will include, at a minimum, the following:

- Visible dust caused by intrusive methods will require work to be paused and the source of the dust corrected by dust suppression.
- Continuous radiological air samples (general area) will be collected during intrusive work within area of known or potential radiological contamination or material.
- Areas with known or suspected radiological material that could become airborne from light winds (fine or powdered material) will be evaluated for a suitable stabilization method (dust control agent, fixatives, surfactants, or covering with erosion control covers).
- Area monitoring with direct reading dust monitors and photoionization detectors.
- Stationary high-volume area sampling.

Additionally, a site-specific dust management and air monitoring plan has been developed (Appendix E). Air permits (e.g., local air quality board) that are required for the performance of work under this contract will be detailed in the project environmental plan.

8.5.1 Radiological Air Sampling

Airborne activity monitoring (continuous or grab samples) and engineering controls may be required during work when deemed appropriate by the license, PRSO, contractor, or the Navy. To control occupational exposures, establish personal protective equipment, and determine respiratory protection requirements, monitoring and trending for airborne radioactive material will be performed as necessary. Engineered controls will be implemented if required to maintain airborne concentrations below the applicable derived air concentration value for the ROCs (Table 9).

During fieldwork, if the airborne concentration exceeds the appropriate derived air concentration, ongoing activities will cease and the affected location will be posted until the source of the airborne concentration is eliminated and levels are confirmed to be below the appropriate derived air concentration. It is not anticipated that airborne contamination would occur.

8.5.2 Nonradiological Area and Personal Air Monitoring

Air monitoring for nonradiological contaminants is expected during fieldwork at HPNS. In keeping with the philosophy of "Zero Dust," engineering controls will be the primary method to eliminate dust. To verify the effectiveness of the controls, the use of area direct reading during monitors may be used. Area dust monitors may be deployed at select locations around the boundary of the site.

In addition, stationary high-volume sampling will include upwind and downwind monitoring for the ROCs, total suspended particulates, arsenic, lead, manganese, particulate matter with particles larger than 10 microns in size, and asbestos.

Monitoring data will be compared with the threshold concentration levels developed for the project site. If an analyte concentration exceeds its threshold level, the upwind and downwind results will be compared to identify whether the exceedance was caused by on-site activities. If on-site activities are found to be the cause of an exceedance, the SSHO will immediately implement corrective actions to enhance the dust control measures being implemented. These measures include, but are not limited to, applying additional water and soil stabilizers, reducing driving speeds on unpaved roads, and modifying the equipment and approach used to perform the work activities.

Breathing zone action levels will be established for nonradiological contaminants, based on prior soil sampling at the site and task (e.g., drilling and excavation). Direct reading monitoring equipment will be used to verify action levels are not exceeded during work tasks.

The need for nonradiological personal integrated air sampling in addition to direct reading monitoring will be evaluated. The APP/SSHP (APTIM, 2019a) will be updated via a field change request if additional monitoring is needed.

8.6 Noise Prevention

Using standard Occupational Safety and Health Administration occupational noise evaluation methods, the time weighted average for an eight-hour period will not exceed 90 decibels to workers. In addition, the contractor will endeavor to limit noise directly resulting from project work at or below 80 decibels at the project boundary, or 70 decibels at the HPNS boundary.

8.7 Construction Area Delineation

Construction area delineation will be evaluated upon arrival of the advance project personnel. Following this evaluation, minor modifications will be made to the project plans and procedures to reflect the current conditions.

8.8 General Operations

General operations will be governed under this WP to ensure that an operation conforms to the requirements listed within. These requirements are specific to the type of hazard (e.g., radiological, hazardous material, health and safety) and further require that each task have a corresponding AHA. Work will be released by the cognizant contractor before work is performed. Review of the general operations AHA will include environmental programs and permits to ensure compliance.

9.0 REFERENCES

American National Standards Institute, 1997, *Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments*, N3232a-1997.

Aptim Federal Services, LLC (APTIM), 2019a, *Final Accident Prevention Plan, Parcels D-2, UC-1, UC-2, and UC-3, Radiological Confirmation Sampling and Survey, Former Hunters Point Naval Shipyard, San Francisco, California.*

APTIM, 2019b, *Final Radiation Protection Plan, Parcels D-2, UC-1, UC-2, and UC-3, Radiological Confirmation Sampling and Survey, Former Hunters Point Naval Shipyard, San Francisco, California.*

APTIM, 2020a, *Final Revision 1 Parcel G Removal Site Evaluation Work Plan Addendum, Radiological Investigation, Survey, and Reporting, Parcel G, Former Hunters Point Naval Shipyard, San Francisco, California*.

APTIM, 2020b, *APTIM Management System*.

CH2M Hill, Inc., 2020. *Final Background Soil Study Report, Base Realignment and Closure, Program Management Office West, Former Hunters Point Naval Shipyard, San Francisco, California*, June.

Naval Facilities Engineering Command, 2012, *Unified Facilities Guide Specifications,* Section 01 35 26, “Governmental Safety Requirements.”

Naval Sea Systems Command, 2004, *Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939–2003, Hunters Point Shipyard, San Francisco, California,* Radiological Affairs Support Office, February.

Pacific Northwest National Laboratory, 2014, *Visual Sample Plan: A Tool for Design and Analysis of Environmental Sampling*, Version 7.0 User’s Guide, Richland, Washington, March.

Tetra Tech EC, Inc., 2012a, *Basewide Radiological Management Plan, Hunters Point Shipyard, San Francisco, California*, February 3.

Tetra Tech EC, Inc., 2012b, *Final Radiological Removal Action Completion Report, Hunters Point Naval Shipyard, San Francisco, California*, March 16.

U.S. Army Corps of Engineers, 2014, *Safety and Health Requirements Manual,* EM 385-1-1, Washington, D.C., November 30.

U.S. Department of Defense, 2013, *Quality Systems Manual for Environmental Laboratories*, Version 5.0, July.

U.S. Department of the Navy (Navy), 2009a, *Final Record of Decision for Parcels D-1 and UC-1, Hunters Point Shipyard, San Francisco, California*, February.

Navy, 2009b, *Final Record of Decision for Parcel UC-2, Hunters Point Shipyard, San Francisco, California*, December.

Navy, 2010, *Final Record of Decision for No Further Action at Parcel D-2, Hunters Point Shipyard, San Francisco, California*, August.

Navy, 2014, *Final Record of Decision for Parcel UC-3, Hunters Point Shipyard, San Francisco, California,* January.

Navy, 2019a, *Final Parcel G Removal Site Evaluation Work Plan, Former Hunters Point Naval Shipyard, San Francisco, California*, June.

U.S. Environmental Protection Agency, 2005, *Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs*, Intergovernmental Data Quality Task Force, EPA-505-B-04-900A, DTIC ADA 427785, Final, Version 1, March <http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf>.

U.S. Nuclear Regulatory Commission, 1981, *Radiation Safety Surveys at Medical Institutions, Regulatory Guide 8.23,* January.

U.S. Nuclear Regulatory Commission, 1998, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG/CR-1507, Washington, D.C.

U.S. Nuclear Regulatory Commission, U.S. Environmental Protection Agency, and U.S. Department of Energy, 2000, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM),* NUREG-1575, EPA 402-R-97-016, DOE/EH-0624, Revision 1, Washington, D.C.

Figures

Figure 1
Site Location Map

Figure 2
Site Layout, Parcels D-2, UC-1, UC-2, and UC-3

Figure 3
Soil and Building Sites, Parcel D-2 (Phase 1, Phase 2, and Building Survey Areas)

Figure 4
Soil Site Parcel UC-1 (Phase 1 and Phase 2 Areas)

Figure 5
Soil Site Parcel UC-2 (Phase 1 and Phase 2 Areas)

Figure 6
Soil Site Parcel UC-3 (Phase 1 and Phase 2 Areas)

Figure 7
Example Phase 1 Trench Unit

Figure 8
Example Phase 2 Trench Unit Soil Sample Locations

Figure 9
Typical Soil Segregation System Layout

Figure 10
Building 813 Floor Plan and SU Layout

Figure 11
Building 819 Floor Plan and SU Layout

Figure 12
Performance Criteria for Demonstrating Compliance with Soil Data

Figure 13
Performance Criteria for Demonstrating Compliance with Building Data

Tables

Table 1
Project Schedule

Activities	Organization	Dates		Deliverable
		Anticipated Date of Initiation	Anticipated Date of Completion	
Draft Work Plan Preparation	APTIM	March 2020	March 2020	Draft Work Plan
Regulatory Review	EPA, DTSC, CDPH, City of San Francisco	March 2020	November 2020	Comments and Responses, Signature
Final Work Plan	Navy and Regulatory Agencies	November 2020	December 2020	Final Work Plan
Field Investigations	APTIM	April 2021	August 2022	None
Laboratory Analyses, Data Validation and Verification, and Data Management	TestAmerica, E-lab Consultants, APTIM	April 2021	August 2022	Analytical and Data Validation Reports
Draft Report Preparation	APTIM	August 2022	October 2022	Draft Reports
Navy Report Review	Navy	October 2022	November 2022	Comments and Responses
Regulatory Report Review	EPA, DTSC, CDPH, City of San Francisco	November 2022	January 2023	Comments and Responses
Report	Navy and Regulatory Agencies	February 2023	February 2023	Final Report

Notes:

APTIM	*Aptim Federal Services, LLC*
CDPH	*California Department of Public Health*
DTSC	*California Department of Toxic Substances*
EPA	*U.S. Environmental Protection Agency*
Navy	*U.S. Department of the Navy*

Table 2
Key Project Personnel

Agency	Contact	Project Title
NAVFAC SW 33000 Nixie Way, Building 50 San Diego, CA 92147	Paul Stoick 619 524 6041 paul.stoick@navy.mil	Navy Lead RPM
NAVFAC SW 33000 Nixie Way, Building 50 San Diego, CA 92147	Liz Roddy 619 524 5755 elizabeth.roddy@navy.mil	Navy RPM
Officer in Charge Naval Sea System Detachment Radiological Affairs Support Office ATTN: Matthew Liscio 160 Main Road Yorktown, VA 23691	Matthew Liscio 757 887 4354 matthew.liscio@navy.mil	Navy Radiological Environmental Protection Manager
NAVFAC SW ROICC San Francisco Bay Area 950 W. Mall Square, Building 1, Suite 163 Alameda, CA 94501	Shirley Ng 510 521 8713 shirley.ng@navy,mil	ROICC Project Engineer
NAVFAC SW CSO Hunters Point Naval Shipyard One Avenue of the Palms, Suite 161 San Francisco, CA 94130	Doug DeLong 415 743 4713 (office) 510 220 1894 (mobile) douglas.delong.ctr@navy.mil	CSO
U.S. Environmental Protection Agency, Region 9 75 Hawthorne Street (SFD-7-3) San Francisco, CA 94105	Wayne Praskins 415 972 3181 praskins.wayne@epa.gov	EPA RPM
California Department of Toxic Substances Control 700 Heinz Ave. Berkeley, CA 94710	Nina Bacey 510 540 2480 juanita.bacey@dtsc.ca.gov	Cal/EPA DTSC RPM
California Department of Public Health Environmental Management Branch, MS 7402 1616 Capitol Ave Sacramento, CA 95899	Sheetal Singh 916 449 5691 sheetal.singh@cdph.ca.gov	CDPH RPM
California Regional Water Quality Control Board San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, CA 94612	Tina Low 510 622 5682 tina.low@waterboards.ca.gov	RWQCB RPM
City and County of San Francisco Department of Public Health 1390 Market St., Suite 210 San Francisco, CA 94102	Amy Brownell 415 252 3967 amy.brownell@sfdph.org	San Francisco DPH RPM
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Nels Johnson 925 288 2170 (office) 925 787 0677 (mobile) nels.johnson@aptim.com	Project Manager

Table 2 (continued)
Key Project Personnel

Agency	Contact	Project Title
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Norm Hanelt 925 383 8622 norm.hanelt@aptim.com	Construction Manager
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Kevin Hoch 925 288 2008 kevin.hoch@aptim.com	QC Manager
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Lee Laws 925 759 1787 lee.laws@aptim.com	PQCM
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Michael Lightner 530 941 3738 michael.lightner@aptim.com	Field Geologist
Aptim Federal Services, LLC 4038 Masonboro Loop Road Wilmington, NC 28409	Raymond Schul 518 496 5533 raymond.schul@aptim.com	Radiological Operations Manager
Aptim Federal Services, LLC 6830 S. Fiddlers Green Circle, Suite 300 Greenwood Village, CO 80111	Amy Mangel 419 350 9429 amy.mangel@aptim.com	Project Health Physicist
Aptim Federal Services, LLC 200 Fischer Avenue Former Hunters Point Naval Shipyard San Francisco, CA 94124	Randall Killpack 415 671 2969 (office) 801 244 2394 (mobile) randall.killpack@aptim.com	Project Radiation Safety Officer/License Authorized User
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Rose Condit 925 288 2151 rose.condit@aptim.com	Program Chemist
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Audrey Engel 916 317 5546 audrey.engel@aptim.com	Project Chemist
Aptim Federal Services, LLC 4005 Port Chicago Hwy, Suite 200 Concord, CA 94520	Mark Egan 925 579 4073 mark.egan@aptim.com	SSHO
Aptim Federal Services, LLC 150 Boush Street Norfolk, VA 23510	Kym Edelman 757 640 6928 (office) 757 435 5384 (mobile) kym.edelman@aptim.com	CIH

Table 2 (continued)
Key Project Personnel

Notes:

CIH	*Certified Industrial Hygienist*
Cal/EPA	*California Environmental Protection Agency*
CDPH	*California Department of Public Health*
CSO	*Caretaker Site Office*
DPH	*Department of Public Health*
DTSC	*California Department of Toxic Substances Control*
EPA	*U.S. Environmental Protection Agency*
NAVFAC SW	*Naval Facilities Engineering Command, Southwest*
PQCM	*Project Quality Control Manager*
QC	*quality control*
ROICC	*Resident Officer in Charge of Construction*
RPM	*Remedial Project Manager*
RWQCB	*California Regional Water Quality Control Board, San Francisco Bay Region*
SSHO	*Site Safety and Health Officer*

Table 3
Phase 1 Trenches

Former Trench Unit Name	Location (Parcel)	Excavation of Original Trench Unit: Estimated Volume (yd^3)	Excavation of Original Trench Unit: Number of Excavation Soil Units	Sidewalls + Bottom: Estimated Volume of 6-Inch Over-Excavation of Sidewalls + Bottom (yd^3)	Sidewalls + Bottom: Number of Sidewall Floor Units	Total: Volume (yd^3)	Total: Number of Units	Total: Number of Systematic Samples
TU-38	D-2	167[1]	1	40	1	207	2	38
TU-134	D-2	483[2]	3	54	1	537	4	76
TU-135	D-2	231[1]	2	23	1	254	3	57
TU-146	UC-1	7,234[1]	37	213	2	7,447	39	741
TU-147	UC-1	7,500[1]	38	250	2	7,750	40	760
TU-164	UC-1	1,659[1]	9	104	1	1,763	10	190
TU-168	UC-1	3,467[1]	19	111	1	3,578	20	361
TU-136	UC-2	4,963[1]	26	124	1	5,087	27	513
TU-137	UC-2	7,207[1]	37	200	2	7,407	39	741
TU-138	UC-2	6,806[1]	35	200	2	7,006	37	703
TU-143	UC-2	395[2]	2	44	1	439	3	57
TU-169	UC-3	4,276[1]	22	214	2	4,489	24	456
TU-174	UC-3	2,815[1]	15	176	1	2,991	16	304
TU-175	UC-3	3,778[1]	20	157	1	3,935	21	399
TU-182	UC-3	4,444[2]	23	233	2	4,678	25	475
TU-185	UC-3	5,841[2]	30	128	1	5,969	31	589
TU-190	UC-3	2,148[1]	11	107	1	2,256	12	228

Notes:

[1] *Estimated volumes were taken from the performance work statement.*

[2] *Estimated volumes calculated using trench area and maximum depth reported for the trench as reported in the Final Radiological Removal Action Completion Report, Hunters Point Naval Shipyard, San Francisco, California (Tetra Tech EC, Inc., 2012b).*

[3] *Estimated volume calculated using area as determined from geographic information system drawing, and maximum depth for the trench as reported in the Final Radiological Removal Action Completion Report, Hunters Point Naval Shipyard, San Francisco, California (Tetra Tech EC, Inc., 2012b).*

yd^3 *cubic yard*

Table 4
Phase 2 Trenches

Former Trench Unit Name	Location (Parcel)	Surface Area (m^2)	Number of Systematic Borings in Original Trench Material	Number of Samples in Original Trench Material	Number of Borings from Sidewalls and Bottom	Number of Samples from Sidewalls and Bottom
TU-31	D-2	184	19	57	4	12
TU-32	D-2	558	19	57	17	51
TU-34	D-2	395	19	57	17	51
TU-35	D-2	465	19	57	16	48
TU-133	UC-1	806	19	57	14	42
TU-139	UC-1	696	19	57	14	42
TU-140	UC-1	934	19	57	18	54
TU-148	UC-1	612	19	57	6	18
TU-150	UC-1	682	19	57	16	48
TU-167	UC-1	422	19	57	6	18
TU-171	UC-1	761	19	57	14	42
TU-141	UC-2	827	19	57	11	33
TU-142	UC-2	951	19	57	11	33
TU-144	UC-2	319	19	57	18	54
TU-145	UC-2	169	19	57	9	27
TU-149	UC-2	804	19	57	10	30
TU-166	UC-3	255	19	57	6	18
TU-170	UC-3	751	19	57	28	84
TU-172	UC-3	314	19	57	12	36
TU-173	UC-3	694	19	57	20	60
TU-176	UC-3	913	19	57	13	39
TU-177	UC-3	906	19	57	11	33
TU-178	UC-3	900	19	57	15	45
TU-179	UC-3	850	19	57	17	51
TU-180	UC-3	857	19	57	22	66
TU-181	UC-3	893	19	57	29	87
TU-183	UC-3	891	19	57	16	48
TU-184	UC-3	459	19	57	10	30

Former Trench Unit Name	Location (Parcel)	Surface Area (m^2)	Number of Systematic Borings in Original Trench Material	Number of Samples in Original Trench Material	Number of Borings from Sidewalls and Bottom	Number of Samples from Sidewalls and Bottom
TU-184A	UC-3	66	19	57	8	24
TU-187	UC-3	757	19	57	15	45
TU-188	UC-3	870	19	57	17	51
TU-189	UC-3	623	19	57	13	39

Notes:

m^2 *square meter*

Table 5
Remediation Goals for Radionuclides

Radionuclide	Soil and Sediment (pCi/g)	Surfaces		
	Residential	Equipment, Waste (dpm/100 cm^2)	Structures (dpm/100 cm^2)	Removable (dpm/100 cm^2)
Cesium-137	0.113	5,000	5,000	1,000
Radium-226	1.0	100	100	20
Strontium-90	0.331	1,000	1,000	200

Notes:

The radium-226 remediation goal is 1 pCi/g above background per agreement with the U.S. Environmental Protection Agency.

Analytical results will be compared to remediation goals or background values, whichever is higher.

dpm/100 cm^2 — *disintegration per minute per 100 square centimeters*
pCi/g — *picocurie per gram*

Table 6
A Priori Soil Scan Minimum Detectable Concentrations

NaI Detector	RG (pCi/g)	MDC (pCi/g)
Ludlum Model 44-20, 3-inch-by-3-inch	^{226}Ra, 1.0	1.42
	^{137}Cs, 0.113	3.26
RS-700	^{226}Ra, 1.0	0.36
	^{137}Cs, 0.113	1.18

Notes:

The RGs will be applied as concentrations above background.

^{137}Cs	*cesium-137*
^{226}Ra	*radium-226*
MDC	*minimum detectable concentration*
NaI	*sodium iodide*
pCi/g	*picocurie per gram*
RG	*remediation goal*

Table 7
Building-Specific Most Restrictive Remediation Goals

Building	RG_α (dpm/100cm^2) and ROC	RG_β (dpm/100cm^2) and ROC
Building 813	^{226}Ra, 100	^{90}Sr, 1,000
Building 819	^{226}Ra, 100	^{137}Cs, 5,000

Notes:

α	*alpha*
β	*beta*
^{90}Sr	*strontium-90*
^{137}Cs	*cesium-137*
^{226}Ra	*radium-226*
dpm/100cm^2	*disintegration per minute per 100 square centimeters*
ROC	*radionuclide of concern*
RG	*remediation goal*

Table 8
Waste Management

Waste Stream	Source/Process	Staged In	Staged At	Final Disposition
Radiological Wastes				
Soil or sediment	Soil sampling/building cleaning activities	In accordance with 40 CFR 173, Subpart I	Navy approved location	Off-site disposal
Concrete and asphalt	Excavation/sampling	In accordance with 40 CFR 173, Subpart I	Navy approved location	Off-site disposal
Potential radiological commodities (e.g., deck markers)	Excavation/sampling	In accordance with 40 CFR 173, Subpart I	Navy approved location	Off-site disposal
Debris including PPE, plastic sheeting, disposable sampling equipment	Investigation activities involving disposable equipment	Include with soil/concrete	Navy approved location	Off-site disposal
Water from decontamination or dewatering	Excavation/sampling/ equipment decontamination/building cleaning activities	In accordance with 40 CFR 173, Subpart I	Navy approved location	Off-site disposal
Nonradiological Wastes				
Soil, sediment, concrete, or asphalt	Soil sampling/building cleaning activities	U.S. Department of Transportation specification drums or containers, intermediate bulk container, or roll-off type bins	Navy approved location	Off-site disposal
Debris including PPE, plastic sheeting, disposable sampling equipment	Investigation activities involving disposable equipment	Include with soil	Navy approved location	Off-site disposal
Water from decontamination or dewatering	Excavation/sampling/ equipment decontamination/building cleaning activities	U.S. Department of Transportation specification drums or containers	Navy approved location	Off-site disposal
Miscellaneous trash that has not contacted contaminated media	Investigation activities	Black opaque trash bags	Removed daily	Dumpsters at the HPNS

Notes:

CFR	*Code of Federal Regulations*
HPNS	*former Hunters Point Naval Shipyard*
PPE	*personal protective equipment*
Navy	*U.S. Department of the Navy*

Table 9
Derived Air Concentrations

Radionuclide	Radiation Type	DAC (µCi/mL)
^{226}Ra	Alpha	3.0×10^{-10}
^{90}Sr	Beta	8.0×10^{-9}
^{137}Cs	Beta/Gamma	6.0×10^{-8}

Notes:

µCi/mL	*microcurie per milliliter*
^{90}Sr	*strontium-90*
^{137}Cs	*cesium-137*
^{226}Ra	*radium-226*
DAC	*derived air concentration*

Appendices A through H

(provided on electronic copy only)

Appendix A
Response to Comments
(reserved)

Appendix B
Sampling and Analysis Plan

Appendix C
Contractor Quality Control Plan

Appendix D
Traffic Control Plan

Appendix E
Dust Management and Air Monitoring Plan

Appendix F
Stormwater Management Plan

Appendix G
Gamma Scanning Minimum Detectable Concentration Calculations

Appendix H
Soil Sorting Operation Plan

(To be provided as an appendix to the final removal site evaluation work plan.)

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling* ... *1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California*, March 2020, DCN: APTI...	
Comments by: Dr. Sheetal Singh, Environmental Project Manager, California Department of Public Health, comments dated...	
General Comments	**Respons...**
1. Please note that CDPH-EMB uses the following criteria in Title 17 of the California Code of Regulations, Section 30256(k) [17 CCR § 20256(k)] to base its evaluation for issuing a Radiological Unrestricted Release Recommendation (RURR): (1) Radioactive material has been properly disposed: (2) reasonable effort has been made to eliminate residual radioactive contamination, if present, and; (3) a radiation survey has been performed which demonstrates that the premises are suitable to release for unrestricted use; or other information submitted by the licensee is sufficient that the premises are suitable for release for unrestricted use.	(1) The Waste Management Plan is inclu... Work Plan (WP) Section 7.0 and includes... the proper management, transportation, a... in Section 7.1, low-level radioactive wast... the Navy's radiological waste contractor... accordance with the MOU. (2) This WP is based on the agency revie... *Removal Site Evaluation Work Plan, For... Shipyard, San Francisco, California* (Par... and the *Final Revision 1 Parcel G Remov... Addendum, Radiological Investigation, S... Former Hunters Point Naval Shipyard, S...* G WPA; APTIM, 2020). This WP is for s... project, but in adjacent Parcels D-2, UC-... design as outlined in the WP demonstrate... reasonable effort to eliminate residual rad... present. (3) WP Section 5 describes how the resul... using this WP will be documented.
2. The method of data evaluation and the determination of background values at Hunters Point Naval Station is still being evaluated and developed in the review process of *REDLINE FINAL Background Soil Study Report Base Realignment and Closure Program Management Office We*st Formal Hunters Point Naval Shipyard San Francisco, California May 2020. The steps of data evaluation included, but not limited to, those in Section 3.1.1.6, Section 5.5, and Section 5.6, in this Work Plan should follow the finalized *Background Soil Study* mentioned above.	The WP was revised throughout to includ... *Final Background Soil Study Report, Bas... Program Management Office West, Form... Shipyard, San Francisco, California* (Fin... CH2M Hill, Inc., 2020).
Specific Comments	**Respons...**
3. Section 1.0 "Introduction", Page 1-2, Paragraph 1, Sentence 1: "The approach for the collection and evaluation of data is based on the ...... and the *Draft Final Parcel G Removal Site Evaluation Work Plan Addendum, Radiological Investigation, Survey, and Reporting, Parcel G, Former* Hunters Point Naval Shipyard, San Francisco, California (APTIM, 2019c). Since the *Draft Final Parcel G Removal Site Evaluation Work Plan Addendum, Radiological Investigation, Survey, and Reporting, Parcel G, Former Hunters Point Naval Shipyard, San Francisco, California* has been finalized in 2020, please update this entry accordingly.	References to the Parcel G WPA were up...
4. Section 2.1 "Site Location and Description", Page 2-1, Paragraph 1, Sentence 5: "Building 823 will not be investigated as part of this task." Please explain why Building 823 is not part of this removal site evaluation work plan.	Per the *Final Historical Radiological Ass... the Use of General Radioactive Materials... Shipyard, San Francisco, California* (HR... [NAVSEA], 2004), Building 823 is not ra... sentence was deleted from Section 2.1 fo...
5. Section 3.1.1.4 "Step Four - Define the Study Boundaries", Page 3-1, Paragraph 11 Sentence 1: "Tables 3 and 4 present Phase 1 and Phase 2 trench locations (Figures 3 through 6)." Since TU-38 and TU-184 were deemed No-Further-Action (NFA) in previous reviews, CDPH requests Navy to remove trench unit (TU) TU-38 and TU-184 from Phase 1 and move these to Phase 2 of evaluation. At the same time, CDPH requests Navy to move TU-34, TU-143,	For clarity, the following Trench Units ha... revised, including all necessary updates t... • TU-38, currently designated for... as proposed in order to maintain... Phase 2 trenches. • TU-184 has been removed from... Phase 2 evaluation.

and TU-181 from Phase 2 to Phase 1 of evaluation. For information related to TU-143, please see the Specific Comments #6.	• TU-34, which is currently locate adjacent to Building 813, has bee will be moved to the Phase 2 eva • TU-134, has been removed from Phase 1 evaluation • TU-143, previously omitted, has evaluation. • TU-181, currently designated fo as proposed. Excavation of TU-1 impact to basewide traffic since across Crisp Road. See also response to EPA specific comm
6. Section 3.1.1.4 "Step Four - Define the Study Boundaries" 1 Page 3-1, Paragraph 1. Sentence 1: "Tables 3 and 4 present Phase 1 and Phase 2 trench locations (Figures 3 through 6)." In Navy's *Draft Radiological Data Evaluation Findings Report for Parcel D-2, UC-1, UC-2, UC-3 Soil*, Former Hunters Point Naval Shipyard San Francisco, California October 2017, Trench Unit 143 in Parcel UC-1 was listed as Recommended for Confirmation Sampling due to lack of remediation record on one elevated Ra-226 sediment sample. However, TU-143 is neither listed in Table 3 and Table 4, nor in Figure 3-6 in this current Work Plan. Please explain why TU-143 is not included in current Work Plan.	TU-143, initially omitted from the Navy has been added to the Phase 1 evaluation. have been updated to reflect this change.
7. Section 3.1.1.4 "Step Four- Define the Study Boundaries", Page 3-1, Paragraph 1. Sentence 1: "Tables 3 and 4 present Phase 1 and Phase 2 trench locations (Figures 3 through 6)." **Trench Unit 184** and **184A** are listed in Table 3 and Table 4 respectively. However, in Figure 6 the area in front of the Building 816 is labeled as **TU184A** and **TU184B**. Furthermore, the same area in front of the Building 816 designated as 2 separate TU 184's in current Work Plan was labeled as **just one Trench Unit 184** in *Navy's Draft Radiological Data Evaluation Findings Report for Parcel D-2, UC-1, UC-2, UC-3 Soil*, Former Hunters Point Naval Shipyard San Francisco, California October 2017. Please explain the decision of splitting the trench unit 184 into 2 separate units in the current Work Plan, and the discrepancy in designation among the Table 3, Table 4 and Figure 6.	TU-184 is physically separated into two s 6.3 of the *Final Radiological Removal Ac UC3, Hunters Point Naval Shipyard, San* 2012), "This trench unit is physically sep north section of TU184 connects to TU17 Area 16 Central) on the west, and TU187 southern section of TU184 connects to TU the west and terminates at Manhole MH5 south section of TU184 was terminated w removal of a concrete pipe grouted into a For clarity, as well as ease of discussion, 184 and 184A which are both part of the response to CDPH Comment 5. For cons with the same nomenclature and TU-184 Table 4 has been updated to include TU-1
8. Section 3.1.1.5 "Step Five - Develop a Decision Rule", Page 3-2, Bullet Point 1: "If one Phase 1 trench does not meet the RAOs, Phase 2 trenches will be excavated." Please add "100%" at the end of this bullet point for clarity.	The first bullet point was revised to be co reviewed and approved Parcel G WP (CH "If one Phase 1 trench does not meet t will be excavated."
9. Section 3.1.1.5 "Step Five - Develop a Decision Rule" 1 Page 3-2, Bullet Points: Following USEPA's 2018 comment on *Draft Work Plan, Radiological Survey and Sampling, Former Hunters Point Naval Shipyard, San Francisco, California*, February 2018, CDPH requests Navy to add a third bullet point in a language similar to "If any Phase 2 TU does not meet the	A third bullet point was added which stat "<u>If any Phase 2 TU does not meet th UC-3 ROD RAO, the TU will be fully as Phase 1.</u>"

Response to Comments on the ***Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling a 1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California*****, March 2020, DCN: APTM**	
Comments by: Dr. Sheetal Singh, Environmental Project Manager, California Department of Public Health, comments dated	
Parcel 0-2, UC-1, UC-2, and UC-3 ROD RAO, the TU will be fully excavated and treated in a manner similar to Phase 1."	
10. Section 3.1.1.5 "Step Five - Develop a Decision Rule", Page 3-2, Bullet Points: Following USEPA's 2018 comment on *Draft Work Plan, Radiological Survey and Sampling, Former Hunters Point Naval Shipyard, San Francisco, California*, February 2018, CDPH requests Navy to add a forth bullet point in a language similar to "If multiple Phase 2 survey units have contamination, then additional survey units may need 100% full excavation and treatment in a manner similar to Phase 1." Additionally, please clarify how many exceedances in Phase 2 will trigger 100% excavation of all the TUs.	The decision rules presented in Section 3 agency reviewed and approved Parcel G noted in the response to CDPH Comment added to clarify additional actions require trigger for 100% excavation of all TUs.
11. Section 3.1.1.6 "Step Six - Specify the Performance Criteria", Page 3-2, Paragraph 2, Sentence 2: "The data evaluation may include, but is not limited to, population-to-population comparisons, use of a maximum likelihood estimate or background threshold value, graphical comparisons, and comparison with regional background levels: ... ". Please see the General Comment #2.	This section is consistent with the Final B Hill, Inc., 2020).
12. Section 3.1.1.7 "Step Seven - Develop the Plan for Obtaining Data", Page 3-3, Paragraph 2, Last Sentence: "If contamination is found during Phase 1, then Phase 2 trenches will be excavated and investigated in a manner similar to that used for the Phase 1 trenches." Please replace the word "similar" to "exact" in the sentence.	Section 3.1.1.7 was revised to state: "If contamination is found during Pha excavated and investigated in the exac trenches."
13. Section 3.3 "Remediation Goals", Page 3-3, Paragraph 2, Last Sentence: "The soil data from the radiological investigation will be evaluated to determine whether site conditions are compliant with the respective RAOs in the RODs (Navy, 2009a, 2009b, 2010, 2014)." The soil data should be evaluated against all the RODs, including any ROD or amendment finalized after 2014.	The RODs cited in the WP are the curren UC-2, and UC-3.
14. Section 3.7.3.1 "Automated Soil Sorting System Process, Soil Sampling and Follow-up Activities", Page 3-23, Paragraph 1, Last Sentence: "Samples will be collected from material moving through the soil sorter before discharge." Please revise the sentence so it describes the soil samples will be collected from a location on the survey belt before the soil material passes the gamma detectors.	The methodology presented in Section 3. agency reviewed and approved Parcel G the Parcel G WPA (APTIM, 2020). No c
15. Section 3.7.3.1 "Automated Soil Sorting System Process, Soil Sampling and Follow-up Activities", Page 3-24, Paragraph 4, Sentence 1: "If elevated sample results are identified by off-site analysis, the contractor will notify the Navy and determine a suitable soil rescreening process, either by RSY pad or by the soil sorter." To prevent further mixing of potential contaminated soil with clean soil during the soil sorter process, the rescreening process should be limited to RSY pad.	The procedures presented in Section 3.7.3 reviewed and approved Parcel G WP (CH changes were made to the WP.
16. Section 3.7.6 "Soil Investigation Near Fischer and Spear Avenues", Page 3-32, Paragraph 3: Please provide Navy's plan regarding the investigation level for the gamma scan and the soil samples in the area near Fischer and Spear Avenue, and the remediation procedure if any contamination is discovered.	The following sentence was added to the "Gamma scan survey measurements instrument-specific IL developed in ac this WP."
17. Section 5.5 "Compare to Background", Page 5-9: Please see the General Comment #2.	Section 5.5 was revised to refer to the Fin Hill, Inc., 2020).
18. Section 5.6 "Determine Equilibrium Status" 1 Page 5-9: Please see the General Comment #2.	Section 5.6 is consistent with the Final Ba Inc., 2020).

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling o 1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California*, March 2020, DCN: APTM	
Comments by: Nina Bacey, Project Manager, Department of Toxic Substances Control, comments dated June 4, 2020	
Specific Comments	**Respons**
1. Section 2.1, Site Location and Description – Please provide clarification on why building 823 is not included in the investigation.	Per the *Final Historical Radiological Ass the Use of General Radioactive Materials Shipyard, San Francisco, California* (HR [NAVSEA], 2004), Building 823 is not ra sentence was deleted from Section 2.1 fo
2. Section 2.3.3, Current Status – Please provide information on the status of building 819 and 823.	The following sentence was added to Sec "Buildings 813 and 819 are currently
3. Section 3.4.4, Phase 1 Trench Design, first paragraph – Please note that the data evaluation findings reports were never finalized and there is no plan to finalize them per the Navy. Please clarify in the text that these are draft documents.	The last sentence of the first paragraph of state: "The Navy's evaluation of the former and former building site surveys co presented in draft radiological data ev
4. Section 3.7.6, Soil Investigation Near Fischer and Spear Avenue – Please state the depths the samples will be collected.	Section 3.7.6, last paragraph was revised "Each sample location will have one s inches of soil, and a second sample f Native fill is expected to be between ground surface and will be verified person overseeing this work. After sa locations will be backfilled with soil c restored to match existing condition investigation for this location will be c
5. Section 8, Environmental Protection Plan – Please indicate that non-plastic netting (biodegradable) wattles will be used.	Concur. Section 8.4.2, third bullet was re "BMPs (i.e., biodegradable wattles, fib used around stockpiles to prevent mat
6. Section 8.4.2, Stockpile Control, Bullet 3 – See Specific Comment #5	Concur. Section 8.4.2, third bullet was re "BMPs (i.e., biodegradable wattles, fib used around stockpiles to prevent mat
7. Section 8.5, Air Quality and Dust Control - Please state that real-time dust monitoring will occur and that activities will comply with the DTSC dust action level of 50 µg/m3 (DTSC 2019). This action level was developed for Parcel G and is appropriate to use for Parcels D-2, UC-1, UC-2, and UC-3.	The Dust Management and Air Monitorin UC-2, and UC-3 was revised to be consis Dust Management and Air Monitoring Pl the DTSC dust action level of 50 µg/m^3.
8. Appendix D, Traffic Plan a. Expected work period may need to be revised. b. Section 1.3, Traffic Notifications – Occupants/leases of the commercial kitchens adjacent to the Site must also be notified because they regularly park their vehicles on Spear and Fisher Avenues.	a. Section 1.2 was updated with the cur b. Section 1.3.1 was revised to include "The Navy will notify HPNS tenants occupants of the commercial kitchen traffic control routes."
9. Appendix E a. Section 2.5 – Please state that real-time dust monitoring will occur and that activities will comply with the DTSC dust action level of 50 µg/m3. Also, include that real-time monitoring stations will be placed within the site in areas closest to residents. b. Figure 1 – Location A does not appear to be in a downwind location. Please indicate that air monitoring station locations may be adjusted based on wind direction and regulatory agency input once fieldwork begins.	a. The Dust Management and Air Mon 1, UC-2, and UC-3 was revised to be Revision 1 Dust Management and A and incorporates the DTSC dust actio b. The air sampling station locations ar in the *Final Basewide Dust Control Shipyard, San Francisco, California* locations provides consistency betwe locations may be adjusted based on s direction. Figure 1, Note 2 states: "A

Response to Comments on the ***Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling a*** ***1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California,*** **March 2020, DCN: APTM**	
Comments by: Nina Bacey, Project Manager, Department of Toxic Substances Control, comments dated June 4, 2020	
	at two stations, one upwind (Station (Station 1, 6A, or 15). Air sampling s potential locations and may be modi site conditions and/or wind direction
10. Appendix F a. Section 2.2 – Please correct schedule dates. b. Section 3.3.2 – See Specific Comment #5. c. Section 3.7.3 – Please indicate that soil covers will be deployed at the end of each workday. d. Section 3.7.9 – Fiber Rolls – See Specific Comment #5.	a. The schedule was updated to reflect b. Added the following text to Section <u>they will consist of burlap rolls, or c</u> <u>products, and will be monitored on</u> <u>does not become entangled, and to e</u> <u>remain effective</u>." c. Revised text to "Soil binders or imp deployed over the stockpiles at the e d. Section 3.7.9 Sanitary/Septic Waste mention fiber rolls. No change was

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling* *1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California,* March 2020, DCN: APTM

Comments by: Wayne Praskins, EPA Project Manager, EPA, comments dated June 5, 2020

Specific Comments	Respons
1. Section 1.5, Project Requirements, Pages 1-3 to 1-4: This section describes several project plans (e.g., sampling and analysis plan, contractor quality control plan, traffic control plan). Please include a description of other project-related plans (e.g., dust management plan, air monitoring plan, stormwater management plan) or clarify why they are not described in this section.	Section 1.5 was revised to include descrip and air monitoring plan and the stormwat
2. Section 2.3.1, Radionuclides of Concern, Page 2-2: This section identifies radionuclides of concern (ROCs) based on the Historical Radiological Assessment and Records of Decision (RODs). Three ROCs are identified for the former sanitary sewer pipelines and storm drains. Considering the downstream location of the former sanitary sewer pipelines and storm drains in relation to other parcels, please further explain the basis for the ROCs.	The radionuclides of concern (ROCs) are RODs. The HRA presents a comprehensi operations by the Navy and Navy contrac prepared using the guidelines provided in Assessment to identify impacted sites and identified ROCs for the sanitary sewers a radium-226, and strontium-90.
3. Section 3.1.1.3, Step Three—Identify Inputs to the Objective, Page 3-1: This section states that "RBA surface and subsurface soil analytical data for ROCs will also be used to confirm, or update as necessary, estimates of naturally-occurring and man-made background levels for ROCs not attributed to Navy operations at HPNS." Please clarify which RBA data and background statistics will be used.	Section 3.1.1.3 was revised as follows: "The inputs include surface soil and for the applicable ROCs and gamma identify biased on soil sample location soil analytical data for ROCs will also as necessary, estimates of naturall background levels for ROCs not att HPNS. <u>The *Final Background Soil St* *and Closure, Program Management* *Point Naval Shipyard, San Francisco* 2020) will be used to determine the ap</u>
4. Section 3.1.1.4, Step Four—Define the Study Boundaries, Page 3-1 (and Tables 3 and 4 and Figures 3-6): The tables list trench units proposed for inclusion in Phase 1 or Phase 2 testing. We recommend two changes: moving TU 134 and TU 181 from Phase 2 to Phase 1, and moving TU 38 and TU 184 from Phase 1 to Phase 2. Our recommendations are based on an analysis completed by EPA and the California Department of Public Health in 2018. - We recommend including TU 134 in the Phase 1 testing because: i) there was low variability in the Tetra Tech EC Bi-214 results (used to determine the concentration of Ra-226); ii) the biased samples had a lower mean and variability than the final status survey (FSS) systematic results (the biased sample mean and variability are typically similar or higher), iii) the range of gamma static measurements was less than the range of gamma scan measurements; and iv) there was evidence that the K-40 and Ac-228 datasets may represent multiple statistical populations. - We recommend including TU 181 in the Phase 1 testing because: i) the gamma scan was conducted before the FSS Samples were collected (indicating the potential for sample collection only in areas with low readings); ii) the range of gamma static measurements (4,580 to 4,846 cpm) was less than the range of gamma scan measurements (5,270 to 7,130 cpm), indicating that areas with low scan results may have been selected for static measurements; iii) the variability in Bi-214 FSS dataset was low; and iv) there was evidence that the K-40 dataset may represent multiple statistical populations.	As presented in response to CDPH comm TU-134 and TU-184 have been updated a necessary to maintain traffic flow across to remain part of the Phase 2 evaluation. ratio of Phase 1 to Phase 2 trenches, it is unchanged as part of the Phase 1 investig Please see the response to CDPH comme

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling a 1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California,* March 2020, DCN: APTM	
Comments by: Wayne Praskins, EPA Project Manager, EPA, comments dated June 5, 2020	
5. Section 3.1.1.5 Step Five—Develop a Decision Rule, Page 3-2: This section (and others, including Section 4.1.1.5, Section 5.2.3, and Appendix B) refer to comparisons of soil retesting data to the Remediation Goals (RGs) at "agreed upon statistical confidence levels." Please clarify the usage of the phrase "agreed upon statistical confidence levels" and contrast with the statement in Section 5.2.2.7 that, "No statistical tests are required for individual data sets because compliance with the RAOs is based on point-by-point comparisons." Please confirm our understanding that each retesting result will be compared to the corresponding RG "point by point" (i.e., sample by sample) and any exceedances not determined to represent background will be remediated.	. The methodology presented in Section 3 agency reviewed and approved Parcel G Each retesting sample result will be comp No changes were made to the text.
6. Section 3.1.1.6, Step Six – Specify the Performance Criteria, Page 3-2 (also Section 5.0, Section 5.2, and Appendix B, Sampling and Analysis Plan, Worksheet #11): The text includes a step in the development of the data quality objectives for the investigation in which sample data are compared "to appropriate RBA data from HPNS" using one or more data evaluation methods. We agree that any sample data with concentrations less than previously agreed to Background Threshold Values (BTVs) represent background. If the Navy believes that a sample exceeding its RG and BTV represents background, the Navy should submit an analysis supporting its conclusion for EPA and State review. The agencies will evaluate the information on a case by case basis. EPA is not, at this time, agreeing that any results exceeding an RG or previously agreed to BTV represent background. The burden of proof will be on the Navy to demonstrate that results above an RG or BTV are not site-related. See comment below on Section 5.5 and EPA's June 2, 2020 comments on the Soil Background Report for further discussion of this topic.	The EPA's comment is noted. The metho 3.1.1.6 is consistent with the agency revie (CH2M Hill, Inc., 2019) and the Final Ba Hill, Inc., 2020).
7. Section 3.3.1, Investigation Levels, Page 3-4: This section states that investigation levels (ILs) will be based on scans and static measurements made at the reference area. We are unable to locate a description or depiction of the reference area in the plan. Please show the location and provide a discussion of the planned reference area, including evidence that it is not impacted by past Navy activities.	Section 3.3.2, Reference Background Are planned soil reference area for scanning n Building 810 and the asphalt RBAs are R the Final Background Study Report (CH2 have been determined to be non-radiolog added to Figure 1.
8. Section 3.4.1, Number of Samples, Pages 3-5 through 3-7: This section describes the Multi-Agency Radiological Site Survey and Investigation Manual (MARSSIM)-based derivation of the number of samples to be collected in each survey unit (SU), determined to be 18 samples. The calculation assigns an arbitrary value for the variance of Ra-226 sample results of 0.25 picoCuries per gram (pCi/g). The Regulatory Agencies have requested collection of 25 samples until site-specific variance data are available. We have proposed that the variance be recalculated after data from three trench units are available.	Using the RBA data from the Final Backg Hill, Inc., 2020), Section 3.4.1 was revise was recalculated. Using the most conserv with the highest standard deviation), N w per SU. The Navy understands the EPA requests 2 TU be collected for the first three TUs an continue to be collected from each TU un TUs are evaluated, and an agreement is re regulatory agencies on the revised MARS systematic samples per TU.
9. Section 3.4.3, Radiological Background, Page 3-7: Please update this section to reflect the BTVs developed as part of the Soil Background Study that will be used to interpret the retesting data.	Section 3.4.3 was revised as follows: "The ^{226}Ra RG presented in Table 5 above background. For the other RG compared to the RGs or backgrou whichever is higher. The BTVs w *Background Soil Study Report, Ba*

	Program Management Office West, *Shipyard, San Francisco, California* (
10. **Section 3.4.4, Phase 1 Trench Design, Pages 3-8 through 3-9:** This section describes circumstances in which elevated results from the analysis of excavated sidewall floor unit (SFU) soils would prompt an in situ investigation of the trench sidewalls and floor. Please describe how the spatial extent of the in situ investigation would be determined.	Phase 1 trenches have between one and tw tracking will identify where the SFU cam the SFU will scanned if further investigat Section 3.4.4 states: "If the investigation surveys and results from the analysis of s of the over-excavated material demonstra RGs and/or background, the material will evaluation. An in situ investigation of the be performed (Section 5.3)." Section 5.3.2 was revised as follows: "The final step in investigating areas is determining the area, or extent, identification of the ROCs present wil additional data are required to dete activity, and the number and type of will be used for that determination. Fo plot of the scan data is generally wh extent of elevated readings. The deter similarly for soil areas when the R activity is readily detected by scan su of elevated activity for ROCs without (such as ^{90}Sr) will require collecting SFUs with elevated activity requiring surface area of the SFU will be in investigation should identify an area o measurements or sample results below
11. **Section 3.4.5, Phase 2 Trench Design, Page 3-10:** This section states that "Table 4 shows the anticipated number of subsurface soil samples; however, additional locations or samples may be required based on the evaluation following analysis of RBA data." Please clarify the meaning of the latter part of the sentence ("additional locations or samples may be required based on the evaluation following analysis of RBA data").	Using the RBA data from the Final Backg Hill, Inc., 2020), Section 3.4.1 was revise was recalculated. Using the most conserv with the highest standard deviation), N w per SU. Section 3.4.5, Table 4, and Figure 8 were samples per SU.
12. **Section 3.5.1, Gamma Instruments, Page 3-12:** This section states that locations that exceed an instrument-specific gamma scanning asphalt IL will be investigated with biased static measurements. Please explain how the asphalt ILs will be established.	Asphalt ILs will be established as describ "Investigation Levels." This section desc determined based on reference area data. Section 3.3.2, Reference Background Are soil reference area is the area behind Buil are RBAs 1, 2, and/or 4, established in th (CH2M Hill, Inc., 2020). These areas hav radiologically impacted. The RBAs were
13. **Section 3.5.2.2, Gamma Scan Minimum Detectable Concentration, Pages 3-13 and 3-14**: The first two bulleted items in the list of inputs used to calculate the gamma scan Minimum Detectable Concentration (MDC) include background count rates obtained from a Treasure Island reference area. Please explain the basis for using reference data from Treasure Island and clarify whether the MDC calculation will be updated with instrument-specific average ambient count rates obtained from the HPNS site.	Treasure Island background count rates w place holder, for the purposes of calculati in Section 3.5.2. The MDCs will be recalc instrument- specific reference area data a calculations presented in Section 3.5.2.2 a reviewed and approved Parcel G WPA (A

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling* ... *1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California*, March 2020, DCN: APT...	
Comments by: Wayne Praskins, EPA Project Manager, EPA, comments dated June 5, 2020	
	The following text was added to the end ... "The MDCs will be recalculated whe... data are available, prior to the beginni...
14. Section 3.5.2.2, Gamma Scan Minimum Detectable Concentration, Pages 3-13 through 3-16 (and Table 6): Please clarify whether the RS-700 MDCs provided in Table 6 apply when the RS-700 is operated in spectral analysis mode. If not, please provide an MDC for each radionuclide.	The RS-700 collects spectral data whenev... provided in Table 6 apply when the RS-7... MDCs for gamma emitting ROCs and are... provided in the agency reviewed and app... 2020).
15. Section 3.6, Debris Screening, Page 3-17: This section states that 25 percent of the segregated debris will be surveyed for alpha/beta loose surface contamination. Please justify why only 25 percent of the segregated debris will be surveyed for alpha/beta loose surface contamination or propose that 100 percent of the segregated debris be surveyed. Also, the text states that "Large debris is not anticipated because this project includes re-excavating backfilled material." As described elsewhere in the plan, the excavated soil will include over-excavated material from trench sidewalls and the trench excavation bottom that has not been previously excavated. One hundred percent of segregated debris from over-excavated areas should be surveyed for alpha/beta.	The second paragraph of Section 3.6 has ... screening will include gamma scanning o... debris and alpha/beta ~~loose~~ surface conta... approximately 25 percent of the segregat... characterization…", with removal of the ... total and removable alpha/beta contamina... The primary rationale for limiting the deb... percent that Navy-related radioactive mat... be gamma/x-ray emitters (such as deck m... 90). Alpha/beta surveys for surface conta... effectiveness on debris that may be caked... If unexpected materials are encountered o... as part of either the gamma survey or the ... level of survey may be increased to furth... Materials that have inaccessible surfaces ... is not possible will be disposed as LLRW...
16. Section 3.7.3.1, Automated Soil Sorting Process, Pages 3-21 to 3-24: The trenches under investigation will remain open until investigation and remediation activities are completed. Please indicate whether Section 7.3.2.1 (Liquids), which indicates that liquid wastes will be stored in 55-gallon drums before disposal, applies if dewatering of the excavations is necessary. If not, please describe how water generated by dewatering will be managed. Table 8 (Waste Management) indicates that water from dewatering will be disposed off-site but does not provide details regarding the management or characterization of the water.	Excavation dewatering is not anticipated ... operation of a dewatering system become... static groundwater level is sufficiently dr... proceed safely or to ensure the proper pla... Navy will be notified, and a dewatering p... implemented in accordance with a field c... advise the regulatory agencies of the field...
17. Section 3.7.3, Phase 1 Trench Investigation, Pages 3-21 to 3-27: This section describes the transfer and stockpiling of excavated trench materials to the soil sorting area. We are unable to locate information on procedures for preventing cross contamination of potentially contaminated soils, including via runoff or windblown dust. Please describe procedures that will be implemented to prevent cross contamination of potentially radiologically contaminated soils as equipment and trucks are moved from one trench to another, during transport to the soil sorting area, and between stockpiles.	Stockpile control is discussed on WP Sec... management and dust control are discuss... Management and Air Monitoring Plan, an... Management Plan.
18. Section 3.7.3.1, Automated Soil Sorting Process, Page 3-23 and Section 7.7, Updating the Waste Management Plan, Page 7-12: Section 3.7.3.1 indicates that changes to S3 soil sorter parameters (e.g., survey belt speed, soil thickness on the belt) will be communicated to the Navy; however, the Regulatory Agencies (e.g., EPA, DTSC, and the California Department of Public Health) should also be informed about any changes to S3 parameters. Similarly, Section 7.7 indicates that revisions to waste management procedures will be reviewed and approved by the Navy but does not indicate	The text in Sections 3.7.3.1 and 7.7 are co... reviewed and approved Parcel G WP (CH... will notify the regulatory agencies throug... to the WP procedures. The regulatory ag... oversee 100 percent of fieldwork. The Final Soil Sorting Operations Work ... the Parcel G WPA (APTIM, 2020), and w... this WP. The SSOP Section 3.2 states: "...

whether the Regulatory Agencies will be informed of any changes to waste management procedures. Please revise the Work Plan to confirm that the Regulatory Agencies be informed about any changes to the S3 parameters and/or waste management procedures.	operating parameters are adjustable by th documented when each adjustment is mad be notified of changes to operating param The Navy will notify the regulatory agen parameters.
19. Section 3.7.3.1, Automated Soil Sorting System Process, Page 3-24 and Appendix D, Traffic Control Plan, Figure 3, Soil Site Parcel UC-1 (Phase 1 and Phase 2 Areas): The Mobilization, Setup, and Calibration subsection of Section 3.7.3.1 indicates that the S3 will be set up and configured at "a suitable location with respect to accessibility, while not impacting load paths for heavy excavation equipment." Figure 3 in Appendix D shows a "Soil Segregation System Area" immediately to the east of Building 813. Please confirm that the location shown in the figure is the planned location for the Soil Sorting System and indicate where soil will be stockpiled.	The location shown on Appendix D, Figu and is subject to change based on actual s construction. Soil piles will be located wi and UC-3, near the S3 during processing following processing. Soil piles may be r radiological data becomes available or as progresses) and do not necessarily have p
20. Section 3.7.3.2, Radiological Screening Yard Pad Process, Page 3-25: This section states that "If no existing RSY pads are available for use, pads will be constructed as necessary. Please revise the Work Plan to provide details regarding the construction and use of any new RSY pads, including measures to prevent contamination of the underlying soil and management of surface water runoff and the planned or possible location(s) of the RSY pads.	Section 3.7.3.2, was revised as follows:: "If no existing RSY pads are available fo RSY pads will be constructed with a size constructing the pad, a gamma scan and a will be conducted of the underlying grou and to determine if there is radiological c baseline gamma scan and gamma static s identifies areas where the count rate exce the area will be flagged. Flagged areas w spectral analysis using the RS-700, or equ the ground surface is soil. If results indica critical level (for spectral analysis) or rele appropriate remediation or relocation of t and will be determined in consultation wi been cleared of potential material generat measurements, the RSY pad will be cons • Area will be covered with 10-mil • Perimeter of the RSY pads will b equivalent) to prevent run-on and run-off • If the existing surface is uneven a different radiological characteristics (e.g. buffer of clean import fill, and/or rock (o the plastic. The buffer material will be vis free of debris/organic matter and of suffic compactable. If the existing surface is ev materials, a buffer layer will not be used. • If used, the buffer soil layer will four passes with an excavator or similar t damage to the plastic sheeting when the e removed. • Baseline radiological survey of th performed prior to the initial placement o baseline survey of the buffer soil (if requ placed on the buffer soil later to prevent c placement of excavated soil.

	• A post-use gamma scan survey w removal of the RSY screened soil, and ag RSY pad itself, to verify that cross-conta underlying surface did not occur. If the g no cross-contamination occurred, the buf contaminated material or may be reused e concurrence.”
21. Section 3.7.3.2, Radiological Screening Yard Pad Process, Page 3-26: The General Process subsection specifies the minimum number of systematic soil samples that will be collected from each pad along with biased samples, if needed, based on the results of the gamma scan and follow-up static surveys; however, the text does not clearly require the collection and analysis of a biased sample if the IL is exceeded during the gamma scan. Consistent with Section 3.4.1 (“a minimum of one biased sample will be collected in every ESU or SFU”), at least one biased sample should be collected at the location of the highest exceedance of the IL during gamma scanning. It may be necessary to collect multiple statics in the vicinity of that location to find the best location for the biased soil sample. Please revise Section 3.7.3.2 to require collection of a biased soil sample at the location of the highest IL exceedance during gamma scanning.	Section 3.4.1 applies to Section 3.7.3.2. was added to the General Process, first pa “<u>Consistent with Section 3.4.1, a mini be collected from each ESU or SFU</u>.”
22. Section 3.7.6, Soil Investigation Near Fischer and Spear Avenues, Page 3-32 This section describes a soil investigation near Fischer and Spear Avenue with the radiological investigation results documented in a remedial action completion report (RACR). Please clarify what will occur should the radiological investigation results indicate that the ROCs exceed the remediation goals provided in Table 5.	If the investigation indicates further actio present the results to the agencies to deter
23. Section 3.7.6, Soil Investigation Near Fischer and Spear Avenues, Page 3-32 and Appendix B, Sampling and Analysis Plan, Figure 10, Proposed Fischer and Spear Avenue Soil Sample Locations for Cesium 137: Figure 10 in Appendix B shows seven locations where soil samples will be collected to evaluate claims by Anthony Smith, a former HPNS worker, that a soil sample collected near the intersection of Fischer and Spear Avenues without proper chain of custody had elevated concentrations of Cs-137. Mr. Smith describes reaching over a waste-high retaining wall bordering Fischer Ave to collect the sample. Based on the scale included in the figure, the seven sampling locations appear to range from about 8 to 25 feet from the retaining wall. Please provide a rationale for the proposed sampling locations and/or move two or more of the sampling locations closer to the retaining wall to ensure that the location described by Mr. Smith is sampled.	Available information states that Anthony hillside in Parcel UC-2. The hillside locat hillside near the intersection of Fischer ar incorporate the information provided by t the samples were moved closer to the reta Figure 10 was revised.
24. Section 3.7.7.1, Deconstruction of Radiological Screening Yard Pads, Page 3-33: This section includes the statement that “The area will be downposted for the deconstruction activities.” Please explain the meaning of downposted.	“Downposted” means the release of radic area after the pre-deconstruction radiolog described in this section. The language is with the agency reviewed and approved F 2019).
25. Section 3.7.7.2, Decontamination and Release of Equipment and Tools, Page 3-33: This section states that decontamination of materials and equipment will be performed at the completion of fieldwork but does not reference the relevant Standard Operating Procedures (SOPs) or discuss how the equipment and tools will be cleared for radiological release. Please revise the text to include this information.	Section 3.7.7.2 was revised to include the “Decontamination of materials and ec <u>required during and between each sepa</u> completion of fieldwork. <u>Decontamin of alpha/beta contamination surve measurements.</u> Numerous decontamin

	use. If practical, manual decontamina Abrasive methods may be necessary i are identified. Chemical decontamina by using detergents for nonporous present. Chemicals should be selected minimize the creation of mixed waste. <u>Visible dirt or debris will be removed and/or a masselin wipe. The equipmen confirm the absence of activity ab (AMS-710-07-WI-40111, "Performin and Contamination Surveys" [APTIM contamination criteria from Radiatio Institutions, Regulatory Guide 8.2 equipment decontamination and relea the RPP (APTIM, 2019b), and proje Detectable levels of activity during notification to the Navy for further dir</u> <u>For larger pieces of equipment, equ will be constructed by placing an imp sheeting) to catch material removed fr equipment will be decontaminated by</u>
26. Section 4.1.1.5, Step Five—Develop Decision Rules, Page 4-1 (and elsewhere): This section refers to the possible presence of naturally occurring radioactive materials (NORM) and anthropogenic background in buildings. Please clarify the distinction between NORM and anthropogenic background in buildings. Which radionuclides might be present as anthropogenic background in buildings?	Anthropogenic background includes back weapons testing fallout. Naturally occurri (NORM) includes background radiation f Anthropogenic background radiation may such as concrete and other structural mate the agency reviewed and approved Parcel
27. Section 4.2, Radionuclides of Concern, Page 4-2 (and Table 7): This section states that the ROC in the Historical Radiological Assessment for Building 813 is Sr-90; however, Table 7 also lists Ra-226 as a ROC for this building. Please review and revise the text as needed to provide consistent information about the ROCs for Building 813.	The HRA identified ^{90}Sr as the only ROC previous building survey included ^{226}Ra a a walkthrough of Building 813, a cabinet placard was found on the first floor. Ther of radioactive materials may have been st physical indications of the presence of ra any location in Building 813. Because of ^{226}Ra and ^{137}Cs as ROCs because these ra radiologically-impacted buildings and are revised as follows: "<u>Although the only</u> R 2004) for Building 813 is ^{90}Sr<u>, ^{137}Cs and</u> <u>ROCs for Building 813 based on observa survey.</u> The ROCs listed in the HRA for Table 7 lists the ROCs for Building 813 a
28. Section 4.4.1.2, Static Measurements, Page 4-4: This section states that "Static measurements will be performed on a systematic sampling grid or biased to locations identified by the alpha-beta scanning surveys." Please confirm our understanding that static measurements will be performed at potential hot spots identified by scanning in addition to the systematic sampling locations. If so, please change "or" to "and" so that the sentence reads: "Static measurements will be performed on a systematic sampling grid and biased to locations identified by the alpha-beta scanning surveys."	The text in Section 4.4.1.2 has been revis "…Static measurements will be performe <u>and</u> biased to locations identified by the a
29. Section 4.4.1.2, Static Measurements, Page 4-4: The last paragraph on page 4-4 (extending onto page 4-5) describes input parameters for	Note that the method described in this sec reviewed and approved Parcel G WP (CH

calculation of the required number of static measurements to be collected in buildings, which includes an assumed background concentration of radionuclides is 0.5 pCi/g, and the assignment of an arbitrary estimate of variance of 0.25 pCi/g. The basis for the 0.5 pCi/g background concentration and variance of 0.25 pCi/g is not provided. Please revise this section to include the basis for these assumptions, and to state when HPNS background and/or site data will be available to update the sample number determination with site-specific background levels and a variance value. The variance obtained from the collection of field data rather than background data will provide the most representative value of variance in site data, and should be used in future calculations to identify the number of measurements required for demonstrating compliance with the RG.	4.4.1.2 states that these values are "[e]xar explaining the process for calculating the frequency. Actual numbers of static meas on reference area data once they become used in the example calculation are unitle will be available after mobilization, and t static measurements for building SUs wil beginning of field work.
30. Section 4.4.3.1, Building 813, Page 4-6: This section proposes that the floor and lower walls of the first floor offices be designated as Class 1, 2, or 3 areas. The upper portion of the walls and the ceilings are not included as Class 1, 2, or 3 areas. No justification is provided. Please revise the Work Plan to clearly demonstrate that the upper walls and ceilings do not contain any contamination or designate as Class 3 areas. A Class 3 designation would be consistent with MARSSIM ("low expectation for residual radioactivity") and provide a limited amount of scanning and/or sampling to confirm that the upper walls and ceilings are not contaminated.	This purpose of this investigation is to res surveyed by the Navy's former contractor building SUs and classifications were pre resurveyed under this WP.
31. Section 4.4.3.2, Building 819, Page 4-6 (and Figure 11): This section says that Building 819 consists of four Class 1 survey units (SUs) and that each SU is less than 100 m2 in area. The figure includes a note that the final SU layout will be determined in the field. Please show a preliminary layout in the figure.	The SU layout of Building 819 will be co the Navy's former contractor, Tetra Tech revised to include the following: "<u>The SUs are the Wet Well (SU 1), t culvert (SU 3), and the bypass culver 11.</u>"
32. Section 4.6.2, Mobilization Activities, Page 4-14: This section states, "Loose, residual debris from past building occupation, investigations, vandalism, or asbestos and lead abatement will be assessed by radiological survey and removed for disposal and to prepare the buildings for cleaning." If additional asbestos or lead abatement may occur before or during retesting, please revise the Work Plan to provide details regarding the abatement activities.	The sentence is not stating that asbestos o performed. The sentence is referring to lo originated from past activities (including asbestos and lead abatement), which will of cleaning the building for surveys. Asb included in the scope of this investigation are required based on actual site conditio prepared and submitted to the Navy for re referenced sentence has been revised to re "Loose, residual debris <u>present in the bui performance of planned surveys</u> will be a and removed for disposal and to prepare t
33. Section 4.6.3.5 Alpha-Beta Swipe Samples, Page 4-16. This section says "The surface activity on the sample will be compared to the total surface activity measured by the static measurement to assess the removable fraction of surface activity. This information will be used in dose or risk assessments performed." Please explain the nature and purpose of the dose or risk assessments that may be performed. Also, please add plans for a comparison of the swipe results to 20% of the RGs to verify the requirement in the July 24, 2009 UC-1 Record of Decision (included as a footnote to Table 5 in the ROD) that: "Limits for removable surface activity are 20 percent of [the RGs].") .	Section 4.6.3.5 text is consistent with the Parcel G WP (CH2M Hill, Inc., 2019). R will be performed using RESRAD-BUIL values detected. The remediation goals shown in the last c removable surface activity limits and they and waste limits. Table 5 is consistent wi *for Parcels D-1 and UC-1, Hunters Poin California* (Navy, 2009). Section 4.6.3.5 follows: "…using a Ludlum Model 3030

	comparison with the RGs for removable surface activity on the sample will be con activity…"
34. Section 4.6.3.8, Remediation of Contaminated Building Surfaces, Page 4-17: This section states that "Specific remediation or decontamination techniques selected will depend on contaminant, type of surface, and other site-specific factors. Type of decontamination that may be performed include concrete scarifying or scabbling, application of strippable surface coatings, and bulk removal of building components." Please provide additional detail on how a remediation or decontamination technique will be selected.	The factors for selecting a given decontar contaminant, type of surface, and other si decontamination technique will be detern documented in the RACR for the site.
35. Section 4.6.3.8, Remediation of Contaminated Building Surfaces, Page 4-17: This section indicates that confirmation measurements will be collected where remediation is performed to verify that contamination was removed; however, details regarding these measurements are not provided and/or referenced. Please revise this section to provide details on the confirmation measurements that will be collected where remediation was performed.	Section 4.6.3.8, Remediation of Contamin sentence was revised as follows: "Confirmation alpha and beta fix measurements will be collected wher verify that contamination has been ren
36. Section 5.0, Data Evaluation and Reporting, Page 5-1: In Section 5.0, and elsewhere, the text states that "Sample and static measurement results at systematic, random, and biased locations are used to evaluate compliance with the RAOs." Please clarify the distinction between random and systematic locations.	In accordance with MARSSIM, samples, measurements, in a Class 3 SU are collec locations, rather than a systematic grid. B SU. The text is consistent with the with th Parcel G WP (CH2M Hill, Inc., 2019).
37. Section 5.2.2.7: Prepare Retrospective Power Curves, Page 5-4: This section states that "Retrospective power curves will be prepared for static and smear survey data from systematic and random locations, and soil sample data from systematic locations for each SU… The retrospective power curve is compared with the DQOs and the Type II decision error rates to evaluate whether a sufficient number of samples was collected." When will the retrospective power curves be prepared and evaluated? If they indicate that the number of samples collected was insufficient, will additional measurements be made?	Retrospective power curves will be prepa data review and reporting process. Additi or may be recommended for future work the collected data set has insufficient stati As stated in Section 5.2.2.7, "No statistic data sets because compliance with the RA comparisons. Because the number of mea determined assuming that a statistical test retrospective power curve assists in deter was adequate, and is not directly related t text is consistent with the with the agency WP (CH2M Hill, Inc., 2019). Because the data will not be used in a sta a survey unit passes or fails, the results o analysis is provided to inform future surv EPA's responses to EPA General Comme Parcel G WP (CH2M Hill, Inc., 2019; EP Appendix A to the Parcel G WP), "Perfor comparison of all data to the RGs is cons previously to demonstrate compliance wi conservative than performing the WRS te
38. Section 5.4, Comparison to RG Values (and elsewhere, including Appendix B, Worksheets #11 and 13): This section says that "total alpha and total beta results will be corrected for material-specific background and reported as net activity above the mean activity for that material from the RBA representing background" and that "The net total activity will be compared directly with the corresponding RG." Section 4.1.1.6 states that "net" static and smear results will be compared to the corresponding RGs. The proposed approach appears to be inconsistent with the process	The basis for the surface contamination v Memorandum was AEC Regulatory Guid footnotes to Table 1: "As used in this table, dpm (disintegratio emission by radioactive material as deterr per minute observed by an appropriate de and geometric factors associated with the

illustrated in Figure 13 and inconsistent with the 2006 Basewide Radiological Removal Action Memorandum and ROD for Parcel UC-1 which states that "Unless otherwise stated, the radiological remediation goals … are based on total activity per sample including the background."	The process described is consistent with t data from the historical work and current
39. Section 5.4, Comparison to RG Values, Page 5-8: This section describes how analytical data will be compared directly with the RGs and/or background, but it is unclear how field duplicates will be evaluated. Please clarify whether the field duplicate results will be used to determine compliance with the RGs and, if so, how they will be used.	Based on previous work at HPNS, the soi heterogeneous. Field duplicate samples w samples. Field duplicate samples will no providing an evaluation of the precision o analytical methods. The heterogeneous na is such that duplicate samples frequently material types or constituents within an a the intended purpose for collection of dup precision will be used to evaluate the ade quality control procedures using laborato and SAP were revised to remove collectio
40. Section 5.5, Comparison to Background, Page 5-9: This section includes statements that "RBA data sets for building surfaces will be developed (Section 4.4.2) to provide building-specific, material-specific, and instrument-specific RBA data. Final selection of RBA data sets will be reviewed by the Navy, EPA, and the State of California." Please clarify in the project schedule when the agencies will receive information on building RBA data and planned building background levels.	Navy will update the regulatory agencies when the data are collected. The regulato welcome to oversee 100 percent of fieldw sufficient time to participate in fieldwork building background levels will be provid after Navy review.
41. Section 5.5, Comparison to Background, Page 5-9: This section describes the possibility that soil sample and building static measurement results exceeding an RG may represent NORM or anthropogenic background. It lists several types of information and data analysis techniques that may be used to compare site data with data from background locations. We agree that a secondary evaluation of results exceeding an RG may be appropriate for radionuclides in which the background concentration is equal to or near the RG. Background concentrations vary across the Site and the calculated BTVs or background levels may not be representative of the full range of background concentrations. After completing an evaluation, if the Navy believes that a sample result exceeding an RG represents background conditions, the Navy should submit its supporting evidence to EPA and its State regulatory partners. The agencies will evaluate the information on a sample-by-sample or location by location basis. We are not agreeing at this time that any results exceeding an RG represent background. The burden of proof will be on the Navy to demonstrate that results above an RG are not site-related.	Data will be evaluated and reported as ou consistent with the agency reviewed and Hill, Inc., 2019). Data evaluation will als outlined in the Final Background Soil Stu 2020).
42. Section 5.7 Reporting, Pages 5-11: This section states that a "removal site evaluation report" will be prepared if investigation results demonstrate conditions non-compliant with RAOs. Please clarify the circumstances in which a removal site evaluation report will be prepared (would it be in addition to and precede a RACR?) and whether it will be submitted to the regulatory agencies.	If contamination beyond the scope of this evaluation report will be prepared in lieu recommendations for further action.
43. Section 7.5, Compliance with CERCLA Off-site Rule, Page 7-11: This section states that, "APTIM will request proof of Off-site Rule approval from the off-site disposal facility before transferring wastes to an off-site	The Navy, via their contractors, confirms current rule approval prior to shipment of

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling* *1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California,* March 2020, DCN: APTM	
Comments by: Wayne Praskins, EPA Project Manager, EPA, comments dated June 5, 2020	
facility.” APTIM (and/or the Navy) should also confirm with EPA’s Region 9 Off-site Rule Coordinator that the disposal facility has current offsite rule approval before shipment of any wastes.	
44. Section 7.5 Compliance with CERCLA Off-site Rule, Page 7-11: This section states that “Hazardous waste (State and Resource Conservation and Recovery Act [RCRA]) will be sent to an off-site, permitted, RCRA Subtitle C treatment, storage, and disposal facility or wastewater treatment facility permitted under the Clean Water Act.” Please explain the basis for the statement that RCRA or California hazardous wastes may be treated or disposed at wastewater treatment facilities permitted under the Clean Water Act.	The referenced sentence has been revised (State and Resource Conservation and Re to an off site, permitted, RCRA Subtitle C facility ~~or wastewater treatment facility p~~ ~~Act~~”
45. Section 7.5 Compliance with CERCLA Off-site Rule, Page 7-11: This section states that, “Decontamination water may be discharged to an on-site water treatment facility.” Please describe the on-site water treatment facilities, if any, and the types of waste they are capable of accepting and properly treating.	There is currently no on-site water treatm previous projects, the Navy has construct and discharged the wastewater to the pub (POTW). If wastewater treatment onsite i will be prepared and submitted to the Nav regulatory agencies of the field change. The text in Section 7.5 is consistent with approved Parcel G WP (CH2M Hill, Inc., to the WP.
46. Section 8.4.2, Stockpile Control, Page 8-2: Please clarify the meaning of the statement that stockpiles will not be inspected (“Stockpiles, although not inspected,”).	The sentence was revised to remove “alth
47. Section 8.6, Noise Prevention, Page 8-4: This section states that efforts will be made to limit noise from project work to 80 decibels at the “project boundary” or 70 decibels at the HPNS boundary. Please define “project boundary.”	The project boundary is the Parcels D-2, boundaries shown on Figure 2.
48. Table 1, Project Schedule: To assist the regulatory agencies in planning oversight activities, please add the following activities to the project schedule, along with anticipated dates of initiation and completion or expected duration: mobilization, utility surveys, the beginning of trench rework, submittal of planned background building levels, and the start date for building scanning.	Navy previously requested not to add this the level of detail similar to the Parcel G
49. Appendix B, Sampling and Analysis Plan, Worksheet #4, Project Personnel Sign-Off Sheet, Page 13: Please add an Enthalpy Analytical representative to the list of personnel required to sign off that he has read the SAP.	Enthalpy laboratory no longer maintains accreditation and was removed from the S identified for testing backfill source mate revised to state the following: “If a clean backfill source is identified this source and all applicable analyti approval for project use. If additional will be sampled prior to use as backfil If additional backfill source is needed, Eu will perform all additional backfill analys revised to include Eurofins-TestAmerica
50. Appendix B, Sampling and Analysis Plan, Worksheet #5, Project Organization Chart, Page 14: Please add NVL Laboratory to the list of analytical laboratories in the project organization chart.	NVL was added to the Organization Char
51. Appendix B, Sampling and Analysis Plan, Worksheet #12, Measurement Performance Criteria Table – Soil Field QC Samples, Page 31: Worksheet #20 indicates that field duplicates and MS/MSDs will be	Please see the response to EPA Commen samples. MS/MSD are not applicable to WS#20 was revised to remove duplicates

collected and analyzed for asbestos in fill material but Worksheet #12 does not list asbestos. Please clarify or correct.	
52. **Appendix B, Sampling and Analysis Plan, Worksheet #14:** The worksheet indicates that "Analytical data will be uploaded into the Navy's centralized database (Naval Installation Restoration Information Solution) and will be included in final reports." What steps will be taken to make sure the data are entered and/or uploaded correctly?	SAP Section 14.2.2, Electronic Deliverab "The laboratory EDD will be in Equis En System format (APTIM database format) follow the requirements stated in the Lab the Analytical Laboratory EDD. After va reviewed and approved by the APTIM Pr submit analytical data to the Naval Instal Solutions in the Naval EDD format."
53. **Appendix B, Sampling and Analysis Plan, Worksheet #15a, Reference Limits and Evaluation Table — Site Contaminants (Soil Matrix-Gamma Isotopes), Page 35:** Footnote #2 indicates that "226Ra background for definitive data is 0.633 pCi/g for this project. If a new background dataset is collected and approved for Navy use, which may establish background concentration for ROCs, that background dataset may be used in place of the existing background concentration." Please clarify whether 0.633 pCi/g or a value derived from the 2019/2020 soil background study will be used.	The footnote was revised to 0.861 pCi/g b Study Report (CH2M Hill, Inc., 2020).
54. **Appendix B, Sampling and Analysis Plan, Worksheet #15.5, Backfill Materials Reference Limits and Evaluation Table – Metals (Soil Matrix), Page 41:** This worksheet indicates that the detection limit (DL) for vanadium is 0.21 milligrams per kilogram (mg/kg), which is greater than the limit of detection (LOD) of 0.20 mg/kg. Similarly, the DL for zinc is listed as 0.63 mg/kg, but the LOD is listed as 0.20 mg/kg. Please revise the Worksheet to resolve these discrepancies.	WS#15.5 – 15.9 were revised to included information since Enthalpy will be remov reviewed and are less than the LODs.
55. **Appendix B, Sampling and Analysis Plan, Worksheet #15.7, Backfill Materials Reference Limits and Evaluation Table – Semivolatile Organic Compounds, Pages 44 to 45:** Footnote 2 states that all LODs are below the project comparison criteria; however, the LOD for N-Nitrosodi-n-propylamine is 0.083 mg/kg, which is greater than the project comparison criterion of 0.078 mg/kg.	The footnote was revised as follows: "LOQ is above the project compariso the comparison criteria. The labora analytes to the LOD and any detecte estimated (J)."
56. **Appendix B, Sampling and Analysis Plan, Worksheet #20, Field Quality Control Sample Summary Table, Page 64:** The table indicates that field duplicate samples will be collected at a frequency of 10% during both Phase 1 and Phase 2 soil sampling. The estimated total number of field duplicates exceeds 900. The purpose of field duplicates is to assess measurement error due to sample collection and handling procedures, analytical procedures, and data production procedures. EPA will consider a revised proposal, and a lower collection frequency, if the Navy believes that an alternative approach can adequately assess measurement error from the planned range of sample collection and handling methods with fewer field duplicate samples.	Based on previous work at HPNS, the soi heterogeneous. Field duplicate samples w samples. Field duplicate samples will no providing an evaluation of the precision o analytical methods. The heterogeneous na is such that duplicate samples frequently material types or constituents within an a the intended purpose for collection of dup precision will be used to evaluate the ade quality control procedures using laborato and SAP were revised to remove collectio
57. **Appendix B, Sampling and Analysis Plan, Worksheet #21, Project Sampling Standard Operating Procedure, Pages 66 to 70:** Step 8 in Section 21.3 (Shallow Soil Sampling) states that samples should be labeled, packaged, and prepared for shipment to the laboratory, but the specific requirements for labeling, packaging, and shipping samples have not been provided. Worksheet #27 (last paragraph in Section 27.2) refers to an SOP for packaging and shipping in Worksheet #21. Step 9 in Section 21.3 states that sample containers will be radiologically released from the radiological areas prior to shipment to the laboratory, but the specific procedures for	Sample packaging, labeling and shipping was revised as follows: "Label, package, and prepare the samples split sample submission <u>in accordance wi</u> WS #21, Section 21.3, Step 9 was revised "Sample containers will be radio radiological areas prior to shipment t

radiologically releasing samples have not been provided. Please describe and/or provide field SOPs for labeling samples, radiologically releasing samples, and sample packaging and shipping.	with AMS-710-07-WI-40123, "Samp Analysis" (Attachment 2)."
58. Appendix B, Sampling and Analysis Plan, Worksheet #22, Field Equipment Calibration, Maintenance, Testing, and Inspection Table, Page 71: This worksheet indicates that radiological controls portable instrument procedures are discussed in the radiation detection instrumentation SOP; however, the specific field equipment that will be used during the current investigation has not been listed. Please revise Worksheet #22 to list field equipment that will be used during the investigation and reference where the specific calibration, maintenance, testing, and inspection requirements can be found (e.g., in the radiation detection instrumentation SOP).	WS#22 was revised as follows: "Radiological field instruments are pr the Work Plan. Radiological controls portable instrum AMS-710-07-WI-04014, "Radiation (Attachment 2; APTIM, 2020)."
59. Appendix B, Sampling and Analysis Plan, Worksheet #24.4, Analytical Instrument Calibration – Chemical Analyses, Page 84 and Worksheet #25, Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table, Page 86: These worksheets indicate that the acceptance criteria for microscope alignment is the acceptability of the refractive index (RI) liquids calibration. This appears to be incorrect as microscope alignment and RI liquid calibration are separate activities. Section 9.2 of SOP 33.308.5 states that microscope alignment shall be performed on a daily basis to ensure proper alignment of optics and operation of the microscope; whereas, calibration of RI liquids is done when transferring RI liquid from the stock bottle to the working RI bottle. Please revise Worksheets #24.4 and #25 as needed to list the correct acceptance criteria for microscope alignment.	Worksheet #24.4, Acceptance Criteria, w "Microscope aligned using Anthophyl liquid to ensure proper alignment o polarizer and analyzer must be set at 9
60. Appendix B, Sampling and Analysis Plan, Worksheet #28.6, Laboratory Quality Control Samples Table (EPA Method 8270), Page 103 and Worksheet #28.9, Laboratory Quality Control Samples Table (EPA Method 8260), Page 108: Worksheets #28.6 and #28.9 do not include acceptance limits and corrective action criteria for internal standards; however, according to Section 10.4 of SOP SVOC 8.1 and Section 8.5 of SOP VOC 2.4, internal standards are required laboratory quality control (QC) samples for these analyses. Please revise Worksheets #28.6 and #28.9 to include acceptance limits and corrective action criteria for internal standards.	Internal standard requirements for VOCs Worksheet #24.4, and are not repeated in
61. Appendix B, Sampling and Analysis Plan, Worksheet #30, ANALYTICAL SERVICES TABLE, Page 111: The Worksheet indicates that laboratory accreditation certifications are provided in Attachment 2 (Laboratory Standard Operating Procedures, Certification, and Control Limits) of Appendix B; however, the accreditation certificate on pdf page 342 has expired and the ones on pdf pages 317 and 328 expire by the end of June. Please revise Appendix B to include current laboratory accreditation certifications.	Appendix B was revised with the current
62. Appendix C, Contractor Quality Control Plan, Section 3.5, Backfill and Site Restoration, Page 3-2: The text indicates that asphalt may be ground and reused to augment backfill material above the water table and below one foot below ground surface. Please revise Appendix C to clarify if the asphalt will be sampled and radiologically cleared before being reused. In addition, please clarify where the asphalt will be ground for reuse.	Asphalt will be radiologically cleared in a Section 3.5.1, which states "The asphalt c considered non-impacted. As a conservat NaI detector will be used to scan the top c asphalt will be turned over and the unders Locations that exceed the instrument-spe will be investigated with biased static me

	Asphalt will be crushed prior to placemen suitability for placement and use as bridg Section 3.5 was revised as follows: Following radiological processing p asphalt may be crushed and reused to a the water table and below 1 foot belo be crushed to 6 inches minus in accor lift thickness specified in the *Final De* *1 and UC-2, Hunters Point Shipya* (ChaduxTt, A Joint Venture of St. G Tech EM Inc., 2010) (Specification Pa directly adjacent to the trench where i
63. **Appendix C, Contractor Quality Control Plan, Section 8.3, Final Acceptance Inspection, Page 8-1:** Section 8.3 of Appendix C does not indicate if the Regulatory Agencies [e.g., EPA, California DTSC, and Water Quality Control Board] will be contacted to participate in the final acceptance inspection. Please ensure that the Regulatory Agencies are contacted and provided the opportunity to participate in the final acceptance inspection.	Regulators are invited and welcome to ov and final inspections and will be notified in fieldwork and final inspections. Regula final inspection. A pre-final inspection fo performed prior to the final with regulato
64. **Appendix C, Contractor Quality Control Plan, Attachment 5, Outside Organizations:** Most of the outside organizations are listed as to-be-determined (TBD). For example, no outside organizations are listed for data validation, geotechnical testing, utility location, waste transportation and disposal. Please ensure Attachment 5 of Appendix C is completed with the outside organizations that will be utilized on the project.	The Final Contractor Quality Control Pla organizations.
65. **Appendix E, Dust Management and Air Monitoring Plan.** Please update the appendix with the Revised Final Parcel G Workplan Addendum Appendix E, making specific D-2, UC-1, UC-2, and UC-3 modifications, such as updating Figure 1. Please include all tables and attachments. This will ensure consistency for the Navy's dust management and air monitoring efforts during the radiological rework at the site.	The Dust Management and Air Monitorin UC-2, and UC-3 was revised to be consis Dust Management and Air Monitoring Pl
66. **Appendix E, Dust Management and Air Monitoring Plan, Section 2 Air Monitoring and Figure 1.** EPA notes that the Navy is proposing a minimum of 2 monitoring locations between the 4 parcels, but 5 air sampling stations and 3 dust monitoring stations are shown in Figure 1. Two of the air sampling stations appear to include monitors at Parcels E and G. Please update Appendix E to provide more detail regarding how decisions will be made regarding how many and which air monitoring sites will be used. Given the length of the parcels, 2 monitoring stations may not provide sufficient coverage depending on how work activities are phased. In addition, the locations of the S3, soil stockpiles, and possible RSY pads in relation to the monitoring sites is unclear. Please update Figure 1 or add another figure to show the monitoring locations and the S3, soil stockpiles, and possible RSY pads.	Figure 1, Note 2 states: Air monitoring w one upwind (Station 1A or 7) and one do Air sampling station locations represent p modified to accommodate changing site c Figure 1 was revised to show the soil sor piles are not shown in Figure 1. Soil piles 2, UC-1, Uc-2, and UC-3, near the S3 du trenches following processing. Soil piles radiological data becomes available or as progresses) and do not necessarily have p are not planned at this time and are not sh
67. **Apparent typos:** **- Section 3.1.1.3, Step Three—Identify Inputs to the Objective, Page 3-1:** There appears to be a typo in "The inputs include surface soil and subsurface soil analytical data for the applicable ROCs and gamma scan survey measurements to identify based on soil sample locations."	Section 3.1.1.3 was revised as follows: "The inputs include surface soil and for the applicable ROCs and gamma identify biased soil sample locations." Section 3.4.5 was revised as follows:

Response to Comments on the *Draft Removal Site Evaluation Work Plan, Radiological Confirmation Sampling a 1, UC-2, and UC-3, Former Hunters Point Naval Shipyard, San Francisco, California*, March 2020, DCN: APTN	
Comments by: Wayne Praskins, EPA Project Manager, EPA, comments dated June 5, 2020	
- Section 3.4.5, Phase 2 Trench Design, Page 3-10: There appears to be a typo in "Figure 8 shows a stylized graphic of an example Phase 2 trench with 18 systematic boring locations places on a triangular grid." **- Section 4.6.3.7 Decontamination and Release of Equipment and Tools, Page 4-17.** There appears to be a typo in the statement that "Chemical contamination can also be accomplished by using detergents for nonporous surfaces with contamination present" ("Chemical contamination" should be "Chemical decontamination"?). **- Section 4.6.3.8, Remediation of Contaminated Building Surfaces, Page 4-17:** There appears to be a typo in the subsection heading (4.3.6.8 should be 4.6.3.8) **- Appendix B, Sampling and Analysis Plan, Worksheet #21, Project Sampling Standard Operating Procedure, Pages 66 to 70:** The plans states that "Backfill soil sampling or shallow soil sampling used to radiologically clear the excavated soil using RSY pads or the S3 to facilitate the MARSSIM (EPA 402-R-97-016, 2000), characterization survey." It appears that one or more words are missing from this sentence. **- Appendix B, Sampling and Analysis Plan, Worksheet #3, Distribution List, Page 11**: The phone number provided for Wayne Praskins is incorrect. The correct number is 415-972-3181. Also, please check the spelling of Nick Ly (Lee?) and Jeanne (Jeannie?) Peterson. Worksheets #3 and #4 use different spellings. **- Appendix B, Sampling and Analysis Plan, Worksheet #15.7, Backfill Materials Reference Limits and Evaluation Table – Semivolatile Organic Compounds, Pages 44 to 45**: There appear to be one or more formatting errors in the table. Three analytes (Bis(2-chloroethyl) ether, Hexachlorobenzene, and N-Nitrosodi-n-propylamine) include a "2" at the end of the analyte name. Is the "2" meant to be a reference to the footnote?	"Figure 8 shows a stylized graphic of a 18 systematic boring locations placed Section 4.6.3.7 was revised as follows: "Chemical decontamination can als detergents for nonporous surfaces wit The subsection heading numbering was c Appendix B, Worksheet #21 was revised "Shallow soil sampling includes back used to radiologically clear the excava S3." Appendix B, Worksheet #3 was revised t number for Wayne Praskins. Nick Ly an Worksheet #4 was revised. Appendix B, Worksheet #15.7, the "2" re was revised to superscripts.

Reference Background Area

Parcel D-2, UC-1, UC-2, UC-3 Boundary

Other Parcel Boundary

N

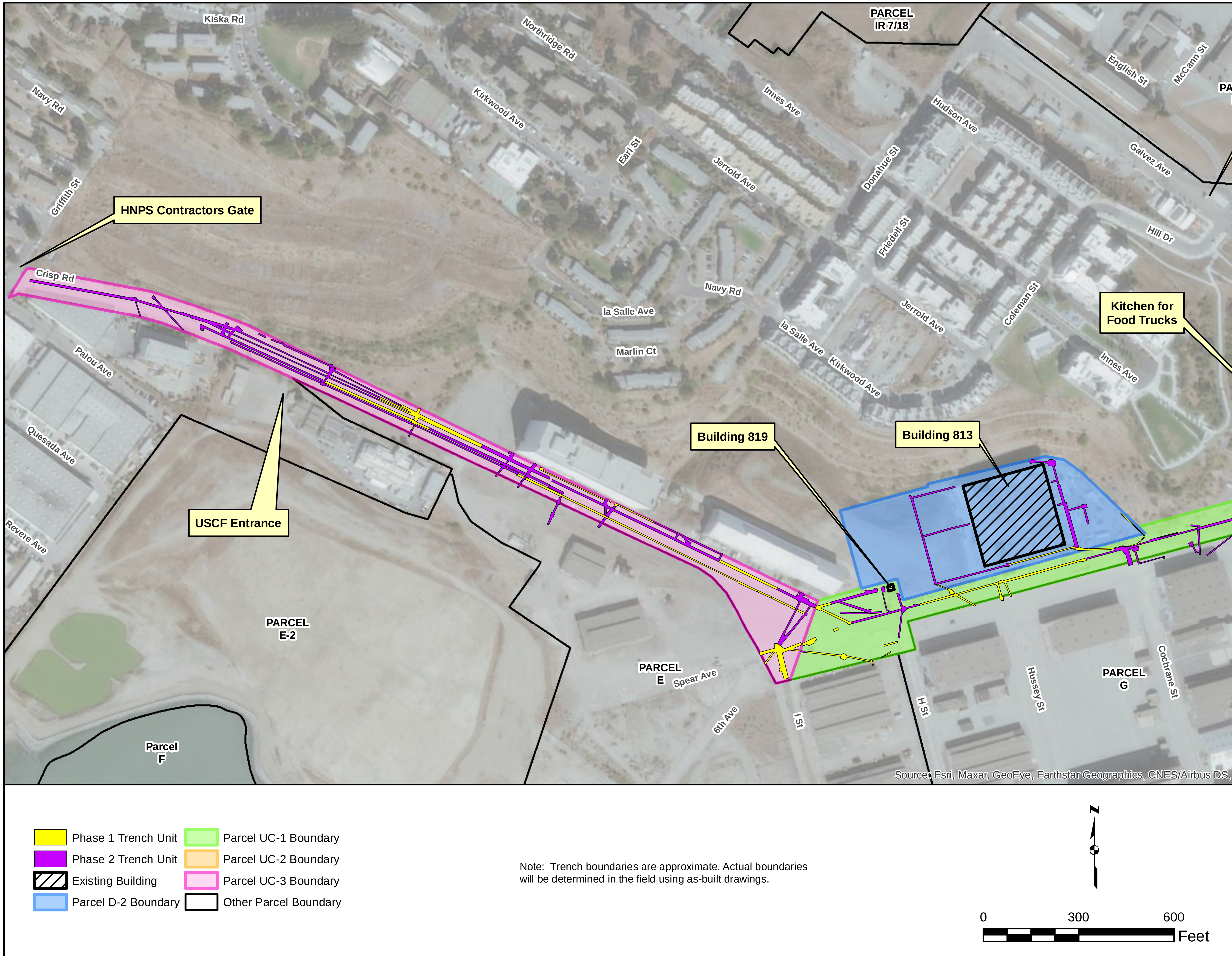
0 800 1,600 Feet

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 1
SITE LOCATION MAP

RADIOLOGICAL CONFIRMATION SAMPLING AND SURVEY
AT PARCELS D-2, UC-1, UC-2, AND UC-3
HUNTERS POINT NAVAL SHIPYARD, SAN FRANSISCO, CA

F:\Projects\HUNTERS_PT\GIS_Documents\Project_Maps\D2_UC123_CTO5345\RAWP\HP_D2_UC123_001_Fig1_Site_Location.mxd 10/19/2020



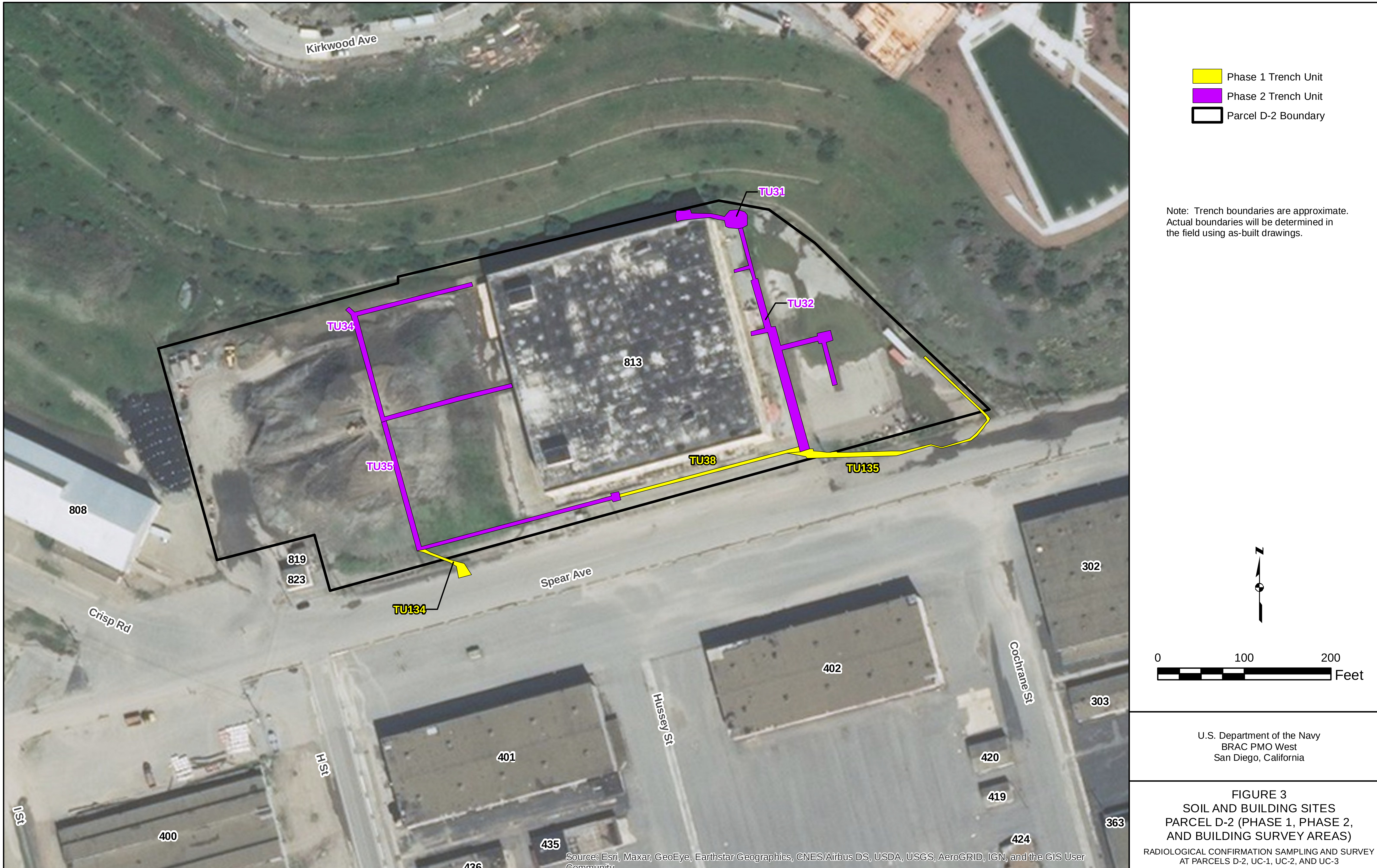
Note: Trench boundaries are approximate. Actual boundaries will be determined in the field using as-built drawings.

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 2
SITE LAYOUT
PARCELS D-2, UC-1, UC-2, AND UC-3

RADIOLOGICAL CONFIRMATION SAMPLING AND SURVEY
AT PARCELS D-2, UC-1, UC-2, AND UC-3
HUNTERS POINT NAVAL SHIPYARD, SAN FRANSISCO, CA

F:\Projects\HUNTERS_PT\GIS_Documents\Project_Maps\D2_UC123_CTO5345\RAWP\HP_D2_UC123_002_Fig2_Site_Layout.mxd 10/19/2020



U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 3
SOIL AND BUILDING SITES
PARCEL D-2 (PHASE 1, PHASE 2,
AND BUILDING SURVEY AREAS)

RADIOLOGICAL CONFIRMATION SAMPLING AND SURVEY
AT PARCELS D-2, UC-1, UC-2, AND UC-3
HUNTERS POINT NAVAL SHIPYARD, SAN FRANSICSO, CA

F:\Projects\HUNTERS_PT\GIS_Documents\Project_Maps\D2_UC123_CTO5345\RAWP\HP_D2_UC123_003_Fig3_D2_Trenches.mxd 10/13/2020

Phase 1 Trench Unit

Phase 2 Trench Unit

Parcel UC-2 Boundary

Note: Trench boundaries are approximate. Actual boundaries will be determined in the field using as-built drawings.

N

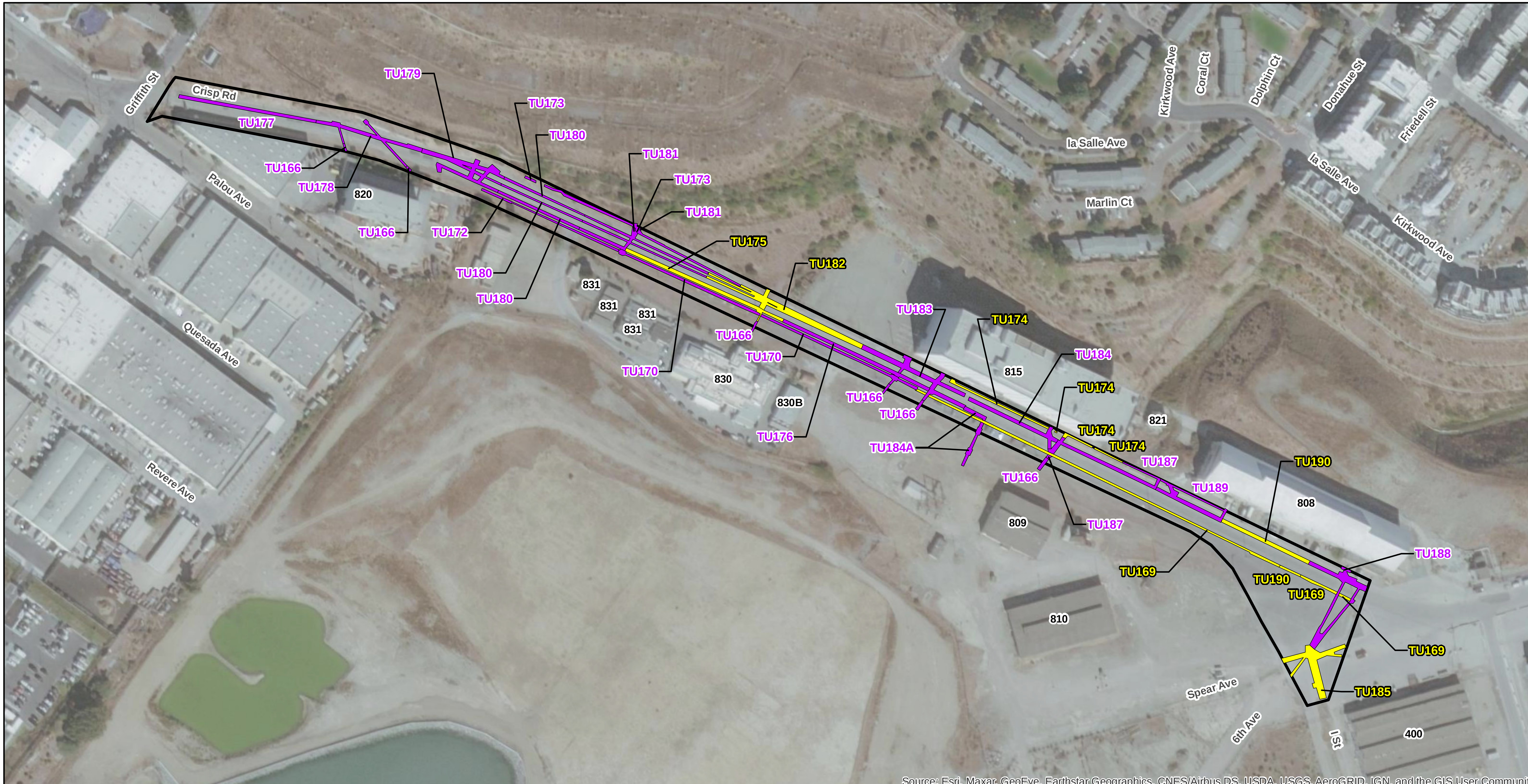
0 90 180 Feet

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 5
SOIL SITE PARCEL UC-2
(PHASE 1 AND PHASE 2 AREAS)

RADIOLOGICAL CONFIRMATION SAMPLING AND SURVEY
AT PARCELS D-2, UC-1, UC-2, AND UC-3
HUNTERS POINT NAVAL SHIPYARD, SAN FRANSISCO, CA

F:\Projects\HUNTERS_PT\GIS_Documents\Project_Maps\D2_UC123_CTO5345\RAWP\HP_D2_UC123_005_Fig5_UC2_Trenches.mxd 10/13/2020



Phase 1 Trench Unit

Phase 2 Trench Unit

Parcel UC-3 Boundary

Note: Trench boundaries are approximate. Actual boundaries will be determined in the field using as-built drawings.

N

0 200 400 Feet

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 6
SOIL SITE PARCEL UC-3
(PHASE 1 AND PHASE 2 AREAS)

RADIOLOGICAL CONFIRMATION SAMPLING AND SURVEY
AT PARCELS D-2, UC-1, UC-2, AND UC-3
HUNTERS POINT NAVAL SHIPYARD, SAN FRANSISCO, CA

F:\Projects\HUNTERS_PT\GIS_Documents\Project_Maps\D2_UC123_CTO5345\RAWP\HP_D2_UC123_006_Fig6_UC3_Trenches.mxd 10/15/2020